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March 8, 2019

Chinny Esakkiperumal
Olin Corporation
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Cleveland, TN 37312

Subject: EPA's Response to Olin's January 2, 2019 Response to EPA's Comments on Olin's Draft Remedial Investigation and Feasibility Study Reports Submitted on September 25, 2018

Dear Mr. Esakkiperumal,

The U.S. Environmental Protection Agency ("EPA") has received and reviewed the above-listed January 2, 2019 Olin Response to USEPA Comments, which were submitted regarding Olin's Draft Remedial Investigation and Feasibility Study documents on September 25, 2018. EPA's comments, and therefore Olin's Response to Comments, were provided in seven separate appendices as follows;

- APPENDIX 1 - Draft Remedial Investigation Report OU3
- APPENDIX 2 - Containment Area Bedrock Boring Results
- APPENDIX 3 - Numerical Modeling for Matrix Diffusion (Appendix H of OU3 RI Report)
- APPENDIX 4 - Revised Rock Matrix Sampling Work Plan
- APPENDIX 5 - Draft Baseline Human Health Risk Assessment OU3
- APPENDIX 6 - Draft Operable Unit 1 & Operable Unit 2 Feasibility Study
- APPENDIX 7 - Draft Operable Unit 3 Feasibility Study

In Appendices 1, 2, 5, 6 and 7, EPA has reviewed Olin's responses and provides a direct response to each comment/response cycle herein. Although Olin's and EPA's responses continue to highlight significant differences between Olin and EPA, as discussed in a meeting held on December 10, 2018, EPA and Olin agree that development of an Interim Action Feasibility Study ("IAFS") shall proceed, and that differences in the CSM can be discussed in the pending interim remedial investigation for groundwater OU3.

EPA's comments on Appendices 3 and 4 pertain to the issues associated with Olin's position that conditions at the Site support a Technical Impracticality ("TI") finding with regard to groundwater restoration. Olin provided a general response which indicates that these issues, that is the numeric modeling effort commented on by EPA in Appendix 3, and the matrix diffusion work plan commented by EPA in Appendix 4, do not need to be resolved to allow the project to move forward and these issues can be resolved on a separate track from the IAFS. EPA acknowledges this conclusion and plans to work with Olin to further these efforts in support of a final Site remedy for groundwater.

On February 20, 2019, EPA and Olin held a technical conference call which, among other things, focused on the containment area and schedule. On this call, Olin agreed to develop a range of remedial alternatives for soil, DAPL, and highly contaminated groundwater, and proposed that highly contaminated groundwater be defined as an NDMA concentration equal to or greater than 11,000 ng/l. Olin also confirmed its intent to submit the IAFS to EPA on April 11, 2019. A schedule to submit a revised interim remedial investigation report for OU3 was not agreed to although Olin agreed that it could proceed without resolving data gaps in the containment area.

During the upcoming meeting on March 26th, Olin shall propose a schedule for submitting the Revised RI (based on the currently available data) within a time frame consistent with the IAFS so that EPA can fully evaluate possible interim response actions. Olin shall also propose a schedule for submitting a workplan to address the data gaps noted in EPA's comments.

EPA, as a matter of routine, would typically not respond to written responses to EPA comments directly as done herein. This effort was put forth in good faith to provide Olin with a clearer understanding of EPA's positions and expectations for the pending interim remedial investigation for groundwater OU3 and the IAFS for the Site. EPA's responses to Olin's response shall not be construed to be a final agency position on the matters addressed herein.

We look forward to further discussion of these issues with Olin in a meeting planned for March 26, 2019. Please feel free to call me at 617-918-1247 if you have any questions. For legal questions, please contact Kevin Pechulis at 617-918-1612.

Sincerely,

James M. DiLorenzo
Remedial Project Manager
USEPA Region 1 - New England

cc: Bryan Olson, EPA
Bob Cianciarulo, EPA
Lynne Jennings, EPA
Kevin Pechulis, EPA
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APPENDIX 1

EPA Comments on Draft Remedial Investigation Report, Operable Unit 3 (March 30, 2018)

Olin Chemical Superfund Site, Wilmington, Massachusetts

GENERAL COMMENTS

1. EPA has completed a comprehensive review of Draft OU3 RI Report ("RI Report" or "Report") including the data supplied in the Report and the Appendices. Based on this review, EPA has concluded that this RI Report does not include an accurate Conceptual Site Model ("CSM") for the Site. In numerous comments below, EPA identifies the issues with Olin's CSM and requires that the Report be revised to incorporate EPA's analysis of the data and a revised CSM. One of the key flaws in the Report is the failure to characterize and discuss the impacts of several large uncontrolled sources of contamination including the DAPL material and the contaminated groundwater in the overburden and shallow bedrock aquifers that continue to migrate uncontrolled. The Report states these sources are "stable." These conclusions are unsupported by the data. The few actions that have been taken to contain or control these sources have not been successful, and the source materials continue to migrate uncontrolled and are therefore not "stable." The Report shall be revised to delete these statements and include EPA's CSM for the Site that there are uncontrolled sources posing a risk to the aquifer and the environment.

Olin Response to Comment 1

As discussed with USEPA at two meetings held in October and December 2018, Olin does not concur with USEPA CSM comments or the alternate CSMs presented by USEPA. Olin has indicated that it is willing to develop a path forward in concert with USEPA to close data gaps necessary to accurately define the CSM. Olin has proposed to revise the OU3 RI using a format that will allow the USEPA CSM to be documented as part of the record while presenting what Olin believes is the appropriate CSM while also documenting what both case teams agree to do reach consensus (including developing and closing data gaps). The USEPA and Olin case teams have agreed to convene a technical meeting in January 2019 to discuss data gaps necessary to develop interim response actions for sources of contamination and higher concentration of aqueous impacts to downgradient groundwater.

Olin has provided an in-depth response to USEPA, citing all cases in which the term stable has been used in RI and FS documents and the context in which the word was used. Olin has agreed to find alternative language to the term stable due to the semantics of how each party interprets the meaning of the word.

Olin and USEPA will identify data gaps and work scope to develop additional information intended to resolve differences in CSM interpretation.

EPA response to Olin Response to Comment 1

EPA does not agree that there are data gaps that need to be filled to develop an interim action feasibility study (IAFS) for source control, which Olin has agreed to submit by April 11. An Interim RI must also be submitted to support the IAFS and to allow for the evaluation of any interim source control response actions. During or before the meeting in March, Olin shall propose a schedule for submitting a revised Interim RI (based on the currently available data) within a time frame consistent with the IAFS so that EPA can fully evaluate possible interim response actions for source control. As discussed, the Interim RI may present both Olin's and EPA's position on the CSM and other significant issues. Once data gaps are filled, as discussed below, a Final RI or an addendum to the RI can be issued to support any further future decisions. (Note that references to the RI or a Revised RI in these responses to Olin's responses shall refer to the "Interim RI," unless expressly stated otherwise.)

As for data gaps, EPA has agreed to review workplans developed by Olin and participate in technical discussions on proposals to collect additional data for the Site because EPA believes that data is needed to fully complete a final RI for issues beyond source control. Thus far, Olin has provided a data gap proposal for the containment area. A technical meeting has been scheduled in March to discuss that proposal and other data gaps. But, there is no comprehensive plan for addressing all the data gaps, including data gaps discussed in EPA's comments. Olin shall also propose a schedule for submitting a comprehensive data gap workplan to address all data gaps. If Olin plans to fill data gaps in phases, the workplan shall clearly identify how and when these phases will be implemented and completed.

EPA has reviewed Olin's proposed replacements for the word "stable" and does not agree with the suggested changes. The issue is not the word that is used, the issue is that EPA does not agree with conclusion. For example, in some cases, the word is used to suggest that the DAPL material is not migrating, that the contamination trends are the same, and that the overall extent of contamination has not changed. EPA does not agree with any of these conclusions. Therefore, the replacement words do not resolve our original comment. Olin shall delete these sentences, or EPA's position shall be added to the revised documents.

2. APPENDIX 2 of this letter contains EPA's comments on the investigation within the containment area to assess the competency of the bedrock beneath the containment area. For the technical reasons provided in the analyses contained in APPENDIX 2, EPA rejects the conclusions of this study. The design of this study was unilaterally developed by Olin and its consultant, Wood, in the absence of regulatory input and/or in conflict with previously supplied comments and suggestions. The study and its conclusions are critically flawed. APPENDIX 2 contains EPA's independent analysis of the bedrock information available for this area. Based on this analysis, EPA maintains that the bedrock beneath the containment area is not competent and that fracture connectivity between the sub-containment area bedrock and known and/or undiscovered fractures likely exists. The RI Report shall be revised to include the analysis and conclusions provided by EPA in APPENDIX 2. Furthermore, while the comments in APPENDIX 2 provide requirements for additional work, this work would refine EPA's conceptual site model, not demonstrate the competency of the bedrock. Olin shall provide a comprehensive response to the comments in APPENDIX 2 and revise the RI Report accordingly. In addition, as discussed in comment 5 below, Olin shall also submit a work plan to address the data gaps noted in Appendix 2.

Olin Response to Comment 2

Olin does not concur with the CSM developed by USEPA as presented in Appendix 2. Olin will address the USEPA CSM in its response to Appendix 2.

Olin acknowledges that one of the bedrock boring casing installations was imperfect and produced a leaky seal between the rock socket and the casing. USEPA chose to interpret the leaky casing as a very large horizontal fracture with an aperture of 34 mm or 1.4 inches based on the borehole geophysical log provided by Olin. Based on the cubic law for fracture flow, a fracture of this magnitude based on empirical data (Klimczak et al 2010) would at a minimum have a hydraulic capacity of 21 cubic feet per minute. During drilling, the borehole yielded on average 0.25 cubic feet per minute (2 gallons per minute), which Olin interprets as casing leakage.

On December 19 2018, Olin and USEPA oversaw grouting of this feature at the bottom of the rock socket using a methodology that both Olin and USEPA concurred with. Had this feature been a 1.4 inch diameter fracture as USEPA postulated it would have taken all the grout very quickly. After 24 hours the solidified grout was well above this feature inside the casing and rock socket. Olin concluded the large horizontal fracture postulated by USEPA was an incorrect interpretation of the borehole geophysical log and that the presence of a large diameter horizontal fracture below the casing of the bedrock boring did not exist. Details of the grouting are provided in Appendix 2 responses.

Olin and USEPA will work toward resolving the CSM at the Containment Area through identification of other data gaps and completing additional investigations. Data collection activities will follow submittal and approval of a work plan.

EPA response to Olin Response to Comment 2

EPA stands by its interpretation of the borehole geophysical log for OC-BB-2-2018. While the size and potential significance of this single specific feature appear to be diminished based on information collected during grouting, the presence of a fracture here can still not yet be ruled out. More to the point, EPA continues to conclude that this feature is simply one of many in a network of shallowly-dipping fractures present in the upper portions of the fractured/weathered bedrock, which likely act as groundwater and contaminant migration pathways in shallow bedrock. For example, EPA's detailed analysis leading to the identification of the casing leakage in OC-BB-2-2018 itemized other shallowly-dipping fractures in the upper intervals (<100 feet into rock) in both OC-BB-1-2018 (at least 14 potential features) and OC-BB-2-2018 (at least 4 potential features).

3. APPENDIX 3 of this letter contains EPA's comments on Appendix H, Numerical Modeling, Draft Remedial Investigation Report, Operable Unit 3, Olin Chemical Superfund Site, Wilmington, MA. For the technical reasons provided in the analyses contained in APPENDIX 3, EPA concludes that the Conceptual Numerical Model is constrained by a general lack of data regarding the nature and extent of the bedrock fracture network beneath the study area. EPA concludes that these data gaps must be addressed to develop a valid Conceptual Numerical Model. Olin shall provide a comprehensive response to each comment raised in APPENDIX 3 and revise the RI Report and Appendix H accordingly. In addition, as discussed in comment 5 below, Olin shall also submit a work plan to address the data gaps noted in Appendix 3.

Olin Response to Comment 3

The purpose of the referenced modeling effort was to illustrate conceptually at a numerical level the importance of fractured bedrock as a long-term sink for NDMA and its implication for the long-term management of the Site. USEPA requested that a work plan be developed to quantify NDMA in rock matrix at the Site. Olin submitted a rock matrix sampling work plan and a revised work plan that were both rejected on the basis that the number and locations of proposed borings were inadequate and a concern micro-fractures would be present in the Main Street DAPL area. USEPA has a considerable difference of opinion as to the CSM for the Main Street DAPL pool. The case teams will meet in January 2019 to discuss data gaps that are needed to reach consensus on the CSM. Olin has also indicated that we are willing to move forward with an interim action feasibility study (IAFS) to develop an interim remedial strategy to address DAPL as a source of contamination as well as higher concentrations of impacts in downgradient groundwater. Given the focus of both parties on developing interim response actions at this time, further modeling to demonstrate technical impracticability will be held in abeyance until a more complete understanding of the impact of interim actions is attained. Olin will therefore defer resolution of comments within Appendix 3.

EPA response to Olin Response to Comment 3

EPA agrees that it appropriate to post-pone the demonstration of technical impracticability. See EPA Response to Olin's Response to Comment 1 for EPA's position on the need for a workplan to address all data gaps.

4. APPENDIX 4 of this letter contains EPA's comments on the Revised Rock Matrix Sampling Work Plan (July 6, 2018) and related information provided by Olin/Wood in a letter dated June 29, 2018. For the technical reasons provided in the analyses contained in APPENDIX 4, EPA disapproves the Revised Rock Matrix Sampling Work Plan on the basis that the single test borehole proposed by Olin is located in an area of known fractures and likely micro-fractures. Results of testing in this proposed borehole would likely yield results that are more representative of groundwater conditions than the rock matrix. For a matrix test to be valid, Olin must demonstrate that the zones to be sampled are free of visible and micro-fractures. Olin shall provide a comprehensive response to each comment raised in APPENDIX 4. In addition, as discussed in comment 6 below, Olin shall also submit a revised work plan to address the data gaps noted in Appendix 4.

Olin Response to Comment 4

The basic underlying premise for matrix diffusion in fractured and fractured porous media over the past 25 years has been that the more fractured a media is, the greater the degree of contact is between fractures and the adjoining matrix and therefore greater is the mass of impacts that may be transmitted to and stored in matrix by diffusion.

USEPA has articulated that the work should be conducted where there is a singular impacted fracture so that the distance from the fracture where matrix affects are present can be studied. In contrast, Olin's interest is in evaluating the mass of NDMA that is stored in the rock matrix between multiple fractures adjacent to the largest and most impacted portion of the fractured bedrock system. The fact that the location proposed by Olin is within an area of known fractures is by design. Fractured bedrock will contain a vast array of fractures of different scales and sizes, even down to the microscopic level. If micro-fractures play a role in diffusion, a work plan can be devised to better understand that role. To

exclude an area from study because it might or does contain micro fractures is to avoid an understanding of the nature of the complexities of the Site as it exists.

As noted above, Olin believes that any further work to develop an understanding of matrix diffusion of Site-related impacts from bedrock should be held in abeyance until the effects of interim response actions are better understood. Olin defers resolution of these comments until that time.

EPA response to Olin Response to Comment 4

EPA maintains its position that Olin's proposal for one bedrock well is insufficient to support Olin's conclusions regarding matrix diffusion. Olin's general theory, as indicated during our discussion on the unvalidated and uncalibrated numerical model, is that large areas of the bedrock matrix have absorbed contamination over time and will act as a long-term ongoing source via processes of "back-diffusion." Moreover, the model suggested that contaminants had penetrated to great distances into the rock matrix from the modeled fractures. This theory can only be validated with a robust investigation, sampling several areas of the matrix. Such an investigation would need to include highly fractured areas, such as those proposed by Olin, as well as unfractured areas at successive distances from known fractures of predetermined importance to contaminant migration. Another pre-condition for such an approach is a detailed knowledge of the fracture network in 3-D at the scale of the focused investigation so that areas of unfractured matrix relative to areas of more intense fracturing may be definitively identified. Since neither of these elements are included in Olin's proposal, it's still unclear from Olin's response how Olin would be able to demonstrate that the results obtained from their proposed investigation could be unequivocally determined to be representative of the rock matrix and not from the water and contaminants contained within the fractures and microfractures, or some combination of matrix and fractures. Therefore, Olin's response is not responsive to EPA's comments. See also EPA Response to Olin's Response to Comment 1 for EPA's position on the need for a workplan to address all data gaps.

As an aside, Olin's states, "To exclude an area from study because it might or does contain micro fractures is to avoid an understanding of the nature of the complexities of the Site as it exists." In contrast, in Appendix 2, with extremely limited information, Olin goes to great lengths to present an interpretation suggesting ubiquitous presence of "tight" (i.e., unfractured) bedrock in the general area enveloping and including the Containment Area (CA). Olin needs to reformulate and it's CSM in an internally-consistent manner that can be used to identify appropriate locations, and to design carefully-controlled testing, which will not result in equivocal results. Perhaps a suitable sub-region of "tight" (unfractured or minimally fractured) rock, in contact with or in close proximity to highly-contaminated source material, can be identified within or near the CA?

5. In addition to the issues with the CSM for the containment area which are summarized in General Comment 2 above, EPA also has numerous and significant comments on Olin's CSM for the areas down gradient, particularly the Main Street DAPL pool area. EPA's evaluation and mapping of the available data demonstrates a very different CSM. The details of this evaluation are presented in comments contained in Appendix 3 and 4. In addition, a summary presentation along with figures is attached as Appendix 1- Attachment 1. In summary, EPA has concluded that a well interconnected set of fractures appears to exist in Main Street DAPL pool area. This interconnected fracture network combined with the shape of the top of rock (TOR) surface in this area provides a variety of migration

pathways from the DAPL area to the low-lying wetland and stream areas to the northwest. This Main Street "spill way" appears to be the dominant controlling hydrogeologic feature which influences both density driven and contaminant migration as well as groundwater flow in both the overburden and bedrock. EPA's analysis and conclusion must be included in the revised RI Report. In addition, this analysis and conclusion shall be included in the workplan, as discussed in comment 6 below, and considered in the plan to collect the data necessary to evaluate this conclusion more fully.

Olin Response to Comment 5

Olin and USEPA will continue its dialogue concerning the Main Street DAPL pool CSM. USEPA's CSM which postulates a large valley (spillway) running through a transverse ridge that forms the western side of the DAPL pool is in conflict with existing data. Olin requested that USEPA look at that data again and USEPA has responded that there is too much uncertainty in the data to draw definitive conclusions and if one considers all the potential possible data errors (as USEPA sees them) there could be multiple discrete DAPL pools within the Main Street DAPL pool with varying DAPL elevations. Olin believes this alternate USEPA CSM equally unlikely.

EPA response to Olin Response to Comment 5

EPA has reviewed the data that Olin presented and does not agree that it supports Olin's CSM. As agreed in the December 10, 2018 meeting, Olin may proceed with an OU3 source control RI (the Interim RI) which presents both interpretations of the CSM in the Main Street DAPL pool area. EPA's comments present an approach to fill the data gaps that exist in this area. EPA awaits a workplan from Olin to fill the data gaps noted in EPA's comments.

6. EPA has concluded that there is insufficient data to support Olin's conclusions regarding the CSM for the bedrock aquifer and the impacts of matrix diffusion on the long-term remedy for the Site. A comprehensive work plan is needed to address these data gaps. It is also important to note (as noted in the attached comments) that as with the work conducted at other sites to demonstrate the technical impracticability of certain goals (like restoration to drinking water standards), the required data collection, if Olin chooses to submit a Technical Impracticability Waiver Evaluation Report, requires several ongoing and iterative steps that will take significant time to design and implement. Such a demonstration also requires a robust demonstration that adequate actions have been taken to control the source. Based on the extensive nature of EPA's comments, the time needed to collect additional data to complete the CSM for the Site, the time needed to conduct a proper Technical Impracticability (TI) Evaluation, and current conditions at the Site, EPA is requiring that the work proceed on two separate tracks and timelines: 1) the development of a feasibility study ("FS") focused on source control actions ("Source Control FS"), and 2) the development of a workplan to begin the process of filling the data gaps needed to complete the CSM which would support the development of a FS for the restoration of groundwater ("Further Groundwater Response Action FS" or "Further Groundwater FS") and the development of a comprehensive TI Evaluation, if Olin chooses to submit that evaluation.

Olin Response to Comment 6

Olin has offered to complete an IAFS. Upon completion of that document, and resolution of differences in the Main Street DAPL pool CSM, Olin will begin developing a DAPL extraction design and a TI evaluation on a separate track. In the process of that work Olin will address comments and technical issues presented in Appendices 3 and 4.

EPA response to Olin Response to Comment 6

EPA agrees with the current schedule for submission of the IAFS. However, a workplan and schedule has not been submitted for the remainder of the work. Therefore, EPA does not agree or concur with the proposal for sequencing the work as noted in Olin's response to comments above. See EPA Response to Olin's Response to Comment 1 for EPA's position on the need for a workplan to address all data gaps.

7. Olin shall submit a workplan that provides a comprehensive approach to address all data gaps identified in comments contained in Appendices 2-6 within 90 days from receipt of this letter. Olin shall also submit the Revised RI Report within 60 days from receipt of this letter. As noted in numerous comments below, EPA is requiring that the Revised RI be updated to include data, maps and figures that are necessary to support the scoping of this new work. The Revised RI shall note that additional investigations are planned and that the RI Report will be supplemented with addendums as needed to document the new findings.

Olin Response to Comment 7

Olin and USEPA are currently engaged in a process that intended to result in agreement on data gaps that need to be filled. This agreement on data gaps may or may not incorporate all data gaps identified in Appendices 2-6 and may include others not contemplated in those appendices. Upon approval of the response to comments, Olin will begin a revision of the OU3 RI.

Olin will structure the data presentation in the RI document to allow updates to incorporate new data.

EPA response to Olin Response to Comment 7

EPA agrees with the schedule proposed by Olin for submission of the IAFS. However, Olin has not provided a schedule for submission of the Revised RI Report and the workplan needed to address the data gaps identified in EPA's comments. See EPA's Response to Olin's Response to Comment 1 for EPA's position on how to proceed.

8. Based on EPA's review and analysis of all the data submitted to date, EPA has determined that the data strongly supports the need for the development of a FS with robust source control alternatives. The Draft OU3 Baseline HHRA documents that the DAPL pools and diffuse groundwater areas provide an unacceptable exposure risk, and EPA has determined that these areas remain an active source of contamination to the broader aquifers. Therefore, source control alternatives shall be developed which address at a minimum: 1) any source material present within the OU1 and OU2 study areas, 2) the OU3 waste within the containment area, including the DAPL and other highly contaminated groundwater in both the overburden and shallow bedrock aquifers within the containment area, 3) the DAPL and other highly contaminated groundwater located in downgradient areas from the Olin Property including Jewel Drive and Main Street, and 4) any groundwater that may be migrating to

impact the surface waters and sediments associated with the Site. Additional data is not needed for the development and finalization of the Source Control FS.

Olin Response to Comment 8

Olin and USEPA have agreed that Olin will prepare an IAFS to address DAPL and control migration of groundwater within the Ipswich watershed. Once the response to comments have been approved Olin will commence revising the OU3 RI and prepare a data gaps work plan. On a parallel track, Olin will begin preparing an Interim Action FS and after sufficient data gaps are resolved, prepare a Further Groundwater FS.

As noted in Appendix 6 and Appendix 7 response to comments USEPA guidance indicates groundwater is not a source material. Groundwater alternatives will be evaluated in the Further Groundwater FS.

EPA response to Olin Response to Comment 8

See EPA's Response to Olin's Response to Comment 1 for EPA's position on the need for a schedule for the Revised RI and a workplan for the investigation to address data gaps. EPA further notes that Olin has agreed to develop and evaluate alternatives that control the migration of highly contaminated groundwater in the IAFS.

9. APPENDIX 5 of this letter contains EPA's comments on the Draft OU3 Baseline Human Health Risk Assessment (March 30, 2018) ("BHRRA"). For the reasons provided in APPENDIX 5, EPA disapproves the BHHRA on the basis that it fails to include a future exposure pathway that evaluates groundwater within the Aberjona watershed as a potential potable source. Olin shall provide a comprehensive response to each comment raised in APPENDIX 5 and revise the BHHRA and the RI Report accordingly. The revised Draft OU3 BHHRA shall be incorporated into the revised Draft OU3 RI Report (not a separate deliverable).

Olin Response to Comment 9

The BHRRA has been revised and submitted to USEPA (December 18, 2018) in accordance with Appendix 5 comments. The BHHRA will be included within the OU3 RI as requested.

EPA response to Olin Response to Comment 9

The revised BHRRA is still under review by EPA. EPA's position on this document will be forthcoming in a separate letter.

10. The RI Report is formatted in a manner that relevant Site characteristics and extent of contamination information is presented separately for the Aberjona and Ipswich River watersheds. EPA acknowledges that the study area contains both watersheds, but presenting the information in this fractured manner is often confusing and suggests that groundwater does not interact between the watersheds. To the contrary, EPA concludes that the watersheds are hydraulically connected through a network of shallow bedrock fractures. EPA notes that groundwater contamination from the primary release area on the Olin Property in the Aberjona watershed (Lake Poly and former lagoons) is detected in the Maple Meadow Brook (MMB) area, which is in the Ipswich River watershed. Olin explains this as the result of DAPL that migrated independent of overlying groundwater, as a separate aqueous phase

liquid, gravimetrically along the bedrock surface, and as diffusive mass transport continuing to impact MMB groundwater. This CSM is incomplete as it shall also be noted that contaminant transport across watershed divides may continue to occur in groundwater via fracture networks. Olin's previous CSM (prior to 2016) did not recognize any movement of DAPL or dissolved-phased contaminants into bedrock. Olin's more recent CSM, which is not included in the Report but was submitted previously as Figure ES-5, acknowledges that significant contamination in the form of DAPL and diffuse groundwater has migrated into the shallow bedrock fractures beneath MMB. As noted in comments on Appendix 2, there is evidence of shallow dipping fractures within the containment area in recently installed borings OC-BB-1-2108 and OC-BB-2-2108. The CSM shall include the possibility of groundwater movement from the containment area in the Aberjona watershed through the fractured bedrock network making contributions to contaminant transport into the Ipswich River watershed. Also, during the period when Olin and its predecessors were operating at the Site, an active municipal well field was present in MMB consisting of 5 deep overburden wells. These municipal wells reportedly extracted more than 2 million gallons per day. This well field was located only about 2,500 feet from the former lagoon and manufacturing areas. EPA has determined that this amount of strain on the aquifer could have resulted in the movement of overburden groundwater containing Site contaminants across the watershed boundary. This scenario would explain the elevated concentrations of TMPs measured in MMB deep overburden and bedrock monitoring wells as shown in Figures 4.4-3.2b and 3.2c (i.e., GW-83D and MP-5#03). TMPs were part of a separate release in the Plant B area of the Site and are not associated with the DAPL release. The CSM shall be expanded to include the migration of source materials from the former manufacturing and lagoon/Lake Poly areas to the MMB area due to: (1) influence on the overburden/deep overburden aquifer from the then active municipal well field; and (2) through the shallow bedrock fracture network which continues to connect the two areas.

The CSM also fails to explain the source of diffuse groundwater in the MMB aquifer. Figure 4.4.1-1b displays the extent of diffuse groundwater located within the deep overburden of the study area. There is a diffuse plume which is clearly associated with the containment area, Jewel Drive and Main Street DAPL pools. This is explained in the current CSM by the ongoing chemical diffusion of Site contaminants from DAPL to overlying groundwater. However, there is also a large broad diffuse plume mapped within the MMB aquifer. While there is empirical evidence of DAPL in shallow bedrock monitoring well GW-83D, no DAPL pool has been mapped in the MMB aquifer. The occurrence of a diffuse plume in the absence of a DAPL pool in the MMB aquifer provides strong evidence that a significant DAPL source remains within the shallow bedrock fractures within the MMB aquifer. The CSM shall be expanded to explain the formation of this large diffuse plume in the MMB aquifer. In summary, the RI Report shall be revised to include all aspects of the CSM as presented in this comment and all other comments provided.

Olin Response to Comment 10

The revised OU3 RI will provide contoured figures for all constituents included the draft OU3 RI and also include formaldehyde, benzene, 1,2 DCA. When new data is collected these figures will be updated.

The revise OU3 RI will address CSM questions noted above. At this time Olin notes the following:

- USEPA has postulated the existence horizontal sheeting fractures due to glacial unloading and prescribed that these fractures would allow movement of bedrock groundwater between

watersheds. This is speculation on USEPA's part. USEPA has not provided an analysis of site specific data to support this claim.

- TMPs are known to be present in DAPL in some wells at the Main Street DAPL pool. TMPs were also located at the former Drum Storage Area, and Plant C and are detected in a number of bedrock wells. The TMPs on the west side of the Containment Area are downgradient from the former Drum Storage Area. The concentrations of TMPs in MMB are well below RSLs are also in wells screened in bedrock. USEPA has indicated it has performed an analysis that demonstrated the TMPs in MMB bedrock are from Plant B. Olin requests USEPA provide its quantitative analysis of fate and transport of TMPs from Plant B to the MMB in response to Town Well pumping. USEPA states these two areas are currently connected through bedrock but provides no supporting analysis. Olin requests that analysis for its review.
- USEPA states there are numerous horizontal fractures in bedrock underlying the Containment Area based on borings OC-BB-1-2108 and OC-BB-2-2108. There may be numerous horizontal features in the borings but they are healed with quartz and are not water bearing fractures. Further work to prove out the CSM for the Containment Area must be defined and completed before further meaningful discussion can be held between Olin and USEPA regarding remedial strategy for this area.

EPA response to Olin Response to Comment 10

EPA's review of the data submitted by Olin thus far supports an alternate CSM than the one presented by Olin in its current draft RI. EPA's comments presented the alternate CSM and identified data gaps that should be filled to refine the CSM for both the Main Street DAPL pool and MMB areas. EPA requested a workplan from Olin to address these data gaps. EPA awaits the submission of Olin's workplan.

11. There are several sections in the Report where evaluations are incomplete and conclusions are not supported with data. Much of the Report attempts to rest on previously submitted documents, several dating back prior to the remedial investigation itself. The RI Report is intended to be a stand-alone document. Where information in previous reports is relevant to the nature and extent of groundwater contamination, the RI Report shall provide an updated comprehensive summary of the data and analysis. In our comment letter dated December 7, 2017, EPA previously identified a number of these issues and most of these comments were not adequately addressed in the Report. EPA has noted those issues again and the Report shall be corrected accordingly.

Olin Response to Comment 11

Many studies have been conducted at this Site for nearly 3 decades. We understand USEPA's desire to have the OU3 RI be stand-alone document. Olin is willing to provide summaries of the prior, relevant studies, but USEPA must concede that an adequate schedule should be developed to respond to this comment appropriately. It is Olin's expectation that our willingness to move forward with a robust, Interim Action Feasibility Study in advance of finalizing the OU3 RI should alleviate, to a degree, the pursuit of such an aggressive RI and FS schedule from USEPA.

EPA response to Olin Response to Comment 11

EPA appreciates that Olin has agreed to produce an IAFS. However, EPA believes that an Interim RI must also be submitted to support the IAFS and to allow for the evaluation of any Interim Response Actions. To the extent EPA and Olin don't agree on the CSM or other key policy issues, EPA suggested that the RI contain a summary both positions. Once the data gaps are filled, an addendum to the Interim RI can be issued to support any further future decisions. Please see also EPA's Response to Olin's Response to Comment 1 for EPA's position on the schedule for submitting these documents.

12. The specific gravity and chemistry statistics used to determine the definitions of DAPL and diffuse groundwater shall be re-evaluated based on the updated samples from the RI. Now that it has been more than 20 years from the initial evaluation and Olin has a substantial new data set, the original assumptions shall be validated to ensure that they are still correct. Further refinement of the term "DAPL" shall include ranges of all key parameters and characteristics of what is considered "DAPL," and what is not considered DAPL. This re-evaluation shall be presented in the RI Report so that it can be reviewed as part of the CSM and approved if EPA agrees with the evaluation.

Olin Response to Comment 12

These data will be reviewed as part of the revised RI.

EPA response to Olin Response to Comment 12

Acknowledged. EPA awaits the submission of the Revised RI.

13. Synoptic water level rounds: Wells have been installed after the 2011 synoptic water level rounds were completed. The additional bedrock wells and wells installed outside of the Olin property have the potential to provide new insight into groundwater flow and contaminant migration. Some limited water level rounds have been conducted since 2011, and these results shall be discussed and figures included in the Report. In addition, a future synoptic water level round (as described in the 3rd paragraph of Section 2.2.3) shall be planned to incorporate as many monitoring wells, piezometers, and surface water points as possible to provide a complete evaluation of groundwater contours.

Olin Response to Comment 13

The revised RI will present interpretations of all synoptic rounds collected to date.

EPA response to Olin Response to Comment 13

Olin has submitted a revised sampling plan to collect approximately 200 groundwater samples from wells across the site to better define the current nature and extent of contamination. As part of the standard sampling procedure, water levels will be collected from these wells during sampling. EPA maintains that a comprehensive synoptic water level monitoring program that incorporates all monitoring wells, piezometers and surface water points is still needed. Olin shall include this activity in the data gaps workplan that has yet to be submitted. The revised Interim RI for the Interim Action FS shall be submitted with an analysis of water level data collected thus far and updated contour maps. An addendum to the RI with a revised analysis of water levels and revised contour maps shall also be submitted once the

comprehensive synoptic water level program has been completed. Olin shall propose a date for this revision to the RI for EPA approval as part of the comprehensive workplan for all data gaps.

14. The data from the private water supply sampling shall be included either as its own appendix or as part of Appendix E of the Report.

Olin Response to Comment 14

Residential data was provided in E-3 with bedrock data. Olin will break residential wells out into a separate Appendix section.

EPA response to Olin Response to Comment 14

Acknowledged.

15. Certain Report sections appear to be contradictory or repeated in separate areas (e.g., both Section 4.2 and 5.1 describe contaminant sources and present data in slightly different ways, leaving the reader to attempt to parse out the most accurate and complete version). The Report shall be revised accordingly.

Olin Response to Comment 15

Olin shall revise the report accordingly.

EPA response to Olin Response to Comment 15

Acknowledged. EPA will review the revised report.

16. In the discussion of Bedrock Geology and Structure (Section 3.2.3), the Report shall include and appropriately reference a figure depicting Olin's understanding of the bedrock lithology and regional fault structures. Figure 3.2-1 of the FRI (MACTEC, 2007) (updated to include observations from more recent borehole geophysics work) may be used for this purpose.

Olin Response to Comment 16

Olin will incorporate a regional review of bedrock geology from published literature.

EPA response to Olin Response to Comment 16

Acknowledged. EPA will review the revised report.

17. Section 5: The discussion of DAPL and groundwater interaction in the Draft OU3 FS Report (AMEC, 2018, Section 1.4.4) has more details regarding bedrock and DAPL migration than Section 5.2 of the RI Report. The Report shall include these details (degree of weathering and location of weathered zones, migration of DAPL, and migration of diffuse groundwater) in Section 5.

Olin Response to Comment 17

The two reports were written simultaneously to comply with USEPA schedule. The resultant discussions have differences in detail and will be merged.

EPA response to Olin Response to Comment 17

Acknowledged. EPA will review the revised report.

18. The bedrock topography is a critical evaluation in terms of DAPL migration and groundwater contamination. Another subsection shall be added to Section 3.2.3 that focuses on bedrock topography. This subsection shall include:

a. the discussion contained in the last two paragraphs currently found in Section 3.2.3;

b. additional cross sections to demonstrate any conclusions discussed; and

c. an evaluation of the competence of the bedrock surface in general and specifically in the areas where DAPL has been identified. Note that borehole geophysics frequently begins below a casing which has been grouted into rock; therefore, boring logs and other indirect measurements of surface competence may need to be used for evaluation.

Olin Response to Comment 18

Olin shall add the requested subsections and information.

EPA response to Olin Response to Comment 18

Acknowledged. EPA will review the revised report.

19. Figures 2.1-1 and 2.1-2, 2.2-1 through 2.2-6, 2.2-10, 3.3-1 and 3.3-2, 3.6-1, and all Section 4 figures contain a thick purple line depicting the Ipswich and Aberjona watershed boundary. Is the source of this boundary the MassDEP watershed delineation, or is it based on Olin's RI work? The figure legends shall be updated with the source information.

Olin Response to Comment 19

The water shed boundaries are from the MassDEP GIS. A note will be added.

EPA response to Olin Response to Comment 19

Acknowledged. EPA will review the revised report.

20. Several tables listed in the Table of Contents are not included in the RI. Additionally, some tables included in the Report are not included in the Table of Contents. Tables 4.1-1 through 4.3-1 as listed in the Table of Contents do not exist in the Report. Table 4.3-1 does exist in the Report but is not the same as what is reported in the contents. Tables 4.4-9 and 4.4-10 are not listed in the Table of

Contents. These missing tables shall be provided and the table of contents shall be updated accordingly.

Olin Response to Comment 20

The table of contents will be reviewed against the final tables and text and any necessary corrections will be made.

EPA response to Olin Response to Comment 20

Acknowledged. EPA will review the revised report.

21. A well construction table including all monitoring wells and multi-level ports shall be included in the RI Report. The table shall include the construction details and current status for all known wells within the study area, including those no longer present. This information has been provided in the past, but has not been provided in an updated form to include all wells installed to date. This information is critical to evaluate subsurface data.

Olin Response to Comment 21

Olin shall combine all newly installed well logs with the historical boring log and well construction compendium so that all data is housed in one document.

EPA response to Olin Response to Comment 21

Acknowledged. EPA will review the revised report.

22. Several documents cited (such as the MACTEC Focused Remedial Investigation [MACTEC, 2007]) are not included in the reference list. All cited documents shall be included in Section 8.0.

Olin Response to Comment 22

Any references that were omitted, were omitted in error and shall be included in the revised document.

EPA response to Olin Response to Comment 22

Acknowledged. EPA will review the revised report.

23. Some figures refer to the Boston Harbor Drainage Basin (Figures 1.2-1 and 3.1-2) while the text refers to the Aberjona watershed. For clarity, the Report shall be consistent in its use of the names of the drainage basins.

Olin Response to Comment 23

Drainage basin legends and names on larger scale and smaller scale figures will be updated for consistency.

EPA response to Olin Response to Comment 23

Acknowledged. EPA will review the revised report.

24. Given the Site history, the RI Report shall include a discussion of the possibility of Per- and polyfluoroalkyl substances (PFAS) on the Site. A workplan shall be submitted by Olin to determine whether PFAS contamination is present at the Site as part of the overall workplan that shall be submitted pursuant to comment 5 above.

Olin Response to Comment 24

Olin has reviewed all available records on material usage at the facility and PFAS or precursors such APFO are not indicated in the records. There are other facilities such as Sanmina that could have used PFOA in its electroplating operations. Olin will include PFAS in the data gaps work plan and update the project QAPP accordingly.

EPA response to Olin Response to Comment 24

EPA has not yet received the data gaps workplan required by EPA's original comments. Please see EPA Response to General Comment 1 for EPA's position on the schedule for development and submission of the data gaps workplan. EPA has received a Revised QAPP for the revised comprehensive groundwater monitoring program. EPA has also received an Addendum to the QAPP for the PFAS Sampling. Please see EPA's letter dated February 22, 2019 for EPA's position on the schedule for submitting a workplan for the PFAS sampling and finalizing the Addendum to the QAPP for this work.

SPECIFIC COMMENTS

1. Page ES-1, 3rd paragraph: EPA disagrees with the statement that the two watersheds have a "fundamentally different potential for future potable use of groundwater." Active use of groundwater currently occurs within each watershed. There is no restriction on future use of groundwater within either watershed, except for the voluntary restriction placed on use of groundwater beneath Olin's own property. The Massachusetts Department of Environmental Protection ("MassDEP") has designated groundwater throughout the entire study area, that is groundwater within both the Ipswich and Aberjona watersheds, to be of "High" Use and Value. The statement cited above in the Report is not supported by the facts and shall be deleted and replaced with discussion that explains that MassDEP has classified the aquifer as a "high use and value" aquifer and has requested that the risks posed to current and future users of the aquifer be assessed.

Olin Response to Comment 1

During the December 10, 2018 meeting, the MassDEP indicated room for discussion on these points. Appropriate language will be developed to review by USEPA and the MassDEP prior to submittal of the revised OU3 RI. consistency.

EPA response to Olin Response to Comment 1

Acknowledged. EPA will review the revised language once it is submitted by Olin.

2. Page ES-1, 4th paragraph: The last sentence states "the actual origin of NDMA has not been identified." Site data shows a pattern of elevated concentrations of NDMA within the densest portions of the plume (commonly referred to as the DAPL pools). This pattern of data clearly demonstrates that the NDMA was released to the aquifers concurrent with the documented manufacturing chemicals such as ammonia, sulfate and chloride. Whether the NDMA was used in the former manufacturing process, or was created either during the manufacturing process or in-situ from pre-cursor chemical compounds discharged during the manufacturing process has no bearing on the current nature and extent of NDMA in groundwater as delineated by the existing data-set. This statement is not supported by the facts and shall be removed.

Olin Response to Comment 2

The statement is true and is consistent with what USEPA has just stated above, with the exception that the DAPL is a source material and not part of the dissolved plume. The statement will be retained in the document. The origin of NDMA has not been determined.

EPA response to Olin Response to Comment 2

EPA does not agree, the statement as drafted is misleading. The site is the source of NDMA and therefore the origin of NDMA is also the site. There is significant evidence to support this conclusion. Although the mechanisms for the formation of NDMA is not completely understood, there is no question that the origin of NDMA stems from contamination at the site. EPA will not approve the revised document if the document contains incomplete or misleading statements. The statement must be deleted or replaced with the following statement: "Although the mechanisms for the formation of NDMA at the site are not completely understood, there is sufficient information to conclude that contamination from the site is the source of NDMA found in groundwater."

3. Page ES-2, 3rd and 4th bullets. These activities are outside the scope of the approved RI/FS Work Plan and are currently under separate review.

Olin Response to Comment 3

Comment noted.

EPA response to Olin Response to Comment 3

Acknowledged. No EPA response required.

4. Page ES-3, 2nd paragraph. This paragraph discusses the development of a "conceptual level numerical model" used to evaluate the fate and transport of NDMA in bedrock. The paragraph then states that the model predicts that the restoration of bedrock groundwater will "take over several hundred years" which makes restoration of bedrock groundwater an "unrealistic expectation and likely to be technically infeasible." Olin had never proposed the use of a numeric model during the RI. The model itself was not presented or discussed anywhere in the RI/FS Work Plan (8/14/2009). Any model used by Olin shall be presented for EPA's review and approval. Until EPA approves the model, its input

parameters and its purpose, the information in this paragraph is considered by EPA to be speculation and shall be removed. See separate Appendix H comments.

Olin Response to Comment 4

The model is a conceptual numerical model based on well established, published, and reviewed computer codes. The numerical results are not speculation and were presented to inform USEPA of the likely existence of fate and transport processes that must be evaluated before any inference on clean-up time frames can be made. Olin believes groundwater restoration is not an achievable objective within reasonable timeframes and will pursue a TI evaluation at the appropriate time.

EPA response to Olin Response to Comment 4

EPA understands Olin's plan to pursue a TI evaluation at a later date. As noted in the original comment, prior to implementing any work on this evaluation, Olin must submit its plan for the evaluation, including any modeling work, in a workplan for EPA review and approval.

5. Page 1-2, Section 1.1, 2nd bullet. States that a Report objective is to determine current groundwater flow directions and gradients. Since the RI Report includes some evaluation of the previous (pumping) flow regime, the objective shall be revised to state that the objective is to determine historical and current flow directions and gradients.

Olin Response to Comment 5

Historical flow directions cannot be determined since we cannot collect representative data. The objective statement will be updated to indicate current conditions will be compared to available historical data for comparison purposes.

EPA response to Olin Response to Comment 5

Acknowledged.

6. Page 1-2, Section 1.1, 3rd bullet. Indicates that one objective of the RI Report is to assess surface water and groundwater interactions by measuring the gradients. The assessment of surface water and groundwater interactions should not be limited to gradient measurements. The text "by measuring the gradient between shallow groundwater and surface water at specific locations" shall be deleted. Additional potential evaluations shall include comparison of contaminant and groundwater chemistry and identification of potential confining units such as fine-grained sediment.

Olin Response to Comment 6

Groundwater and surface water contaminant distributions and data were compared in the OU2 RI, concluding that shallow groundwater in the MMB was not impacting surface water. The exception to this were metals impacts to surface water from the Spinazzola Trust landfill. Text will be amended to reflect results of prior evaluations.

EPA response to Olin Response to Comment 6

Acknowledged. EPA will review the revised report to determine if it fully addresses the comment.

7. Page 1-2, Section 1.1, 4th bullet. Indicates that the objective of the bedrock evaluation in the RI Report is to assess groundwater quality surrounding the DAPL pools near Eames Street, Main Street, Jewel Drive, and Cook Avenue. The bedrock evaluation shall include all areas where bedrock contamination may be reasonably suspected, which includes any areas of known bedrock contamination, bedrock located beneath elevated concentrations in the deep overburden, and areas downgradient of or along fracture sets emanating from known areas of bedrock contamination. The Report shall be revised and the evaluation corrected.

Olin Response to Comment 7

The objective statements will be reviewed and modified as needed to reflect the scope of the document and the OU3 RI effort.

EPA response to Olin Response to Comment 7

Acknowledged. EPA will review the revised report to determine if it fully addresses the comment.

8. Page 1-3, Section 1.2, first sentence. The text shall be revised to state that the Site includes the areas described in addition to wherever contamination from Property manufacturing and waste disposal practices has come to be located.

Olin Response to Comment 8

Appropriate modification to text will be incorporated.

EPA response to Olin Response to Comment 8

Acknowledged. EPA will review the revised report to determine if it fully addresses the comment.

9. Page 1-3, Section 1.2, second paragraph, second sentence. The text refers to process waters and wastes that were discharged to unlined excavations. These locations shall be described (e.g., the former Lake Poly and others) and a reference to these locations on a figure (such as Figure 1.3-2) shall be added.

Olin Response to Comment 9

References and citations will be added as requested.

EPA response to Olin Response to Comment 9

Acknowledged.

10. Page 1-3, last paragraph. Near the end of this paragraph which continues onto p. 1-4, the text states that "the DAPL and groundwater that immediately overlies the DAPL [referred to elsewhere as diffuse

groundwater] also contain low level concentrations of VOCs and SVOCs." TCE and Bis-2-ethylhexlphathalate both exceed the federal MCL. While there is no federal or state MCL for NDMA, the concentration of NDMA frequently exceeds the tap water RSL of 11 ng/l. Since the definition of "low" is subjective, these statements shall be revised and replaced with factual statements that indicate how the concentrations compare to MCLs, other ARAR cleanup goals, and risk-based standards.

Olin Response to Comment 10

Revisions to the statement will be made as requested.

EPA response to Olin Response to Comment 10

Acknowledged

11. Page 1-4, Section 1.2, third paragraph. The Report shall clarify which chemical manufacturing buildings are referred to, and add a reference to a figure showing the buildings. Figure 1.3-2 shows the various buildings associated with Olin operations, but does not refer to a group of chemical manufacturing buildings per se.

Olin Response to Comment 11

The figure shows which buildings were associated with Plants A, B, C and D. Olin shall add a table from the RI work plan which describes all the known manufacturing processes, products and years of operation associated with each Plant. Other buildings shown include warehouses, final product storage buildings, laboratories, and the administration building.

EPA response to Olin Response to Comment 11

Acknowledged

12. Page 1-6, Section 1.3, third paragraph, second sentence. The statement refers to an Environmental and Open Space Restriction "described above", but the restriction is not mentioned before the statement. A reference to (can be to a later section) or discussion of this restriction shall be added to the Report.

Olin Response to Comment 12

The reference will be corrected and a description added.

EPA response to Olin Response to Comment 12

Acknowledged

13. Page 1-6, Section 1.3, fifth paragraph. A reference to a figure depicting the on-property and off-property water bodies described, such as Figure 1.3-1, shall be added to the Report.

Olin Response to Comment 13

Figure 1.3-1 shall be referenced.

EPA response to Olin Response to Comment 13

Acknowledged

14. Page 1-8, Section 1.3.2, third paragraph, last sentence. Section 2.1.2.2.2 of the FRI (MACTEC, 2008) does not have any additional information not included in this section; this reference shall be omitted and the Report shall retain only the reference to the original C-RAM status report (GEI, 2004).

Olin Response to Comment 14

The requested change will be made.

EPA response to Olin Response to Comment 14

Acknowledged

15. Page 1-8, Section 1.3.2, 4th paragraph (and Section 2.1.1.1, 4th paragraph). These paragraphs describe the slurry wall equalization window, which allows free movement of shallow groundwater in and out of the containment structure. Given that waste was retained in place for slurry wall construction and that a DAPL pool is present in this area, it is likely that contamination will diffuse upward and re-contaminate the shallow groundwater that passes into and out of the equalization window. The Report shall discuss potential mass flux from the equalization window. Note that this mass flux was calculated within the "Semi-Annual Analysis of Post-Construction Monitoring Plan Data" report included as an appendix to the Construction RAM status report 8 (GEI, 2004).

Olin Response to Comment 15

The report will provide a discussion of mass flux through the equalization window. The report will also note that shallow groundwater impacts outside the slurry wall (such as TMPs) are higher than within, and have been since the wall was constructed.

EPA response to Olin Response to Comment 15

Acknowledged, subject to review of the new text.

16. Page 1-9, Section 1.3.4. The Report shall show the 20 acres of the Environmental and Open Space Restriction on a figure and refer to it in this subsection.

Olin Response to Comment 16

The information will be provided as requested.

EPA response to Olin Response to Comment 16

Acknowledged

17. Page 1-9, Section 1.3.6: The East Ditch (both the upper and lower sections) shall be added to this subsection. These ditches may be an important component to evaluate contaminant fate and transport in shallow groundwater north of the Olin property where the NDMA plume was encountered.

Olin Response to Comment 17

A discussion of East Ditch surface water will be added from the OU2 RI. The shallow groundwater from GW-413 and deeper groundwater data indicate the northern portion of East Ditch is not capturing groundwater to any significant extent. Father north flow in the ditch ceases as the ditch becomes dry where it encounters bedrock.

Surface water sample EDSD/SW1 (EDBS5) located slightly south of GW-413 detected 3 ng/L NDMA on 12/13/10 and was non-detect on 6/8/11. Downstream near GW-415 EDSD/SW0 was non-detect for NDMA on 12/13/10 and 6/8/11.

EPA response to Olin Response to Comment 17

Note Olin's response here seems to contradict Olin's response to Comment 68. Does the East Ditch function as a hydraulic barrier or not? The response as drafted does not address EPA's original comment. Olin's response here seems to contradict Olin's response to Comment 68. The OU3 RI Report shall clearly discuss whether the East Ditch functions as a hydraulic barrier or not and provide a basis for the conclusion.

18. Page 1-10, DAPL: Several comments on the "DAPL" equation/definition. The equations shall be updated to determine if it is still accurate for defining DAPL. The base equation/definition is as follows:

    The definition of DAPL is based on having a specific gravity greater than 1.025 which can be estimated by an empirical relationship of its primary constituents, and by threshold concentrations, as follows:

    - Ammonia concentration greater than 1,250 milligrams per liter (mg/L);
    - Chloride concentration greater than 2,800 mg/L;
    - Magnesium concentration greater than 270 mg/L;
    - Sodium concentration greater than 1,700 mg/L;
    - Sulfate concentration greater than 16,000 mg/L; and
    - Specific conductance greater than 20,600 micro-ohms per centimeter (µmhos/cm).

The equation for Specific Gravity (SG) is:

SG = 2.6 x 10-7 x SO42- + 1.3 x 10-6 x Na+ + 3.7 x 10-6 x Cl- + 7.4 x 10-7 x NH3 + 1.01

Comments:

a. This analysis was completed in 1999 by Geomega. It shall be updated using the data collected since then to see if the analysis is still a reasonable predictor. For example, Olin uses Specific Conductance greater than 20,600 umhos/cm to determine the top of the DAPL. The Report shall confirm that this is still an accurate figure. Include an updated analysis in the revised Report.

b. The equation indicates that the Specific Gravity would increase with an increase in ammonia, however, ammonia has a density less than 1, and an increase in ammonia will decrease, not increase SG. The equation shall be corrected to reflect this issue.

c. The Report states that NDMA concentrations in DAPL overlap with those found in overlying diffuse groundwater and therefore the concentration is not a reliable indicator of DAPL. This analysis shall be included in the revised Report.

d. WERC suspects SG of 1.025 was selected to define the DAPL because marine water has an SG of 1.025. A different SG could have been selected, such as 1.01 and a thicker "DAPL" would be defined. Include detailed analysis of the selection of 1.025 and why this represented a "statistically distinguishable population compared to the groundwater samples from diffuse/ambient groundwater" (p. 2-13) in the revised Report.

e. A better definition/equation of "DAPL" would include pH. pH controls the "plugging" by precipitates of the soil and is a key parameter for pumping the DAPL. The Report shall provide the relationship between pH on the 'DAPL' parameters in the revised Report.

f. Vertical profiles of each parameter in the "DAPL" shall be provided in the Report. Profiles shall include, where available, bedrock, "DAPL", Diffuse Layer" and the remainder of the groundwater.

Olin Response to Comment 18

The revised RI report will include a response to "a" through "d" above. With regard to comment "e": pH will be discussed with regard to DAPL but Olin does not agree pH is useful in the definition of DAPL. After Olin has resampled all five MP wells; data will be presented to satisfy comment f.

EPA response to Olin Response to Comment 18

The definition of DAPL and the physical parameters such as pH that affect the ability to remove DAPL from the aquifer are important concepts that should be fully evaluated and explained in the Revised Draft RI. Olin's response states that it does not agree that pH is useful in the definition of DAPL but does not provide any further explanation of its position. Therefore, the response as drafted is not responsive to EPA's original comment. The revised RI Report shall include further discussion of pH as it relates to the various layers and provide further explanation of Olin's position that pH should not be considered in the definition of DAPL.

19. Page 1-11, Section 1.3.7, 1st paragraph. This text states "DAPL also contains low and trace concentrations of other metals, TMPs, SVOCs (mostly phthalates) and NDMA with maximum historical detected concentrations up to 64 ug/L (64,000 nanograms per liter [ng/L])." Consistent with the earlier comment, Bis-2-ethylhexlphathalate exceeded its MCL 17 known times. The maximum historical detected concentration of NDMA is nearly 6,000 times higher than the tap water RSL of 11 ng/l. Consistent with previous comments, statements that describe contamination as low shall be replaced with factual statements comparing the concentrations to MCLs, other ARAR cleanup goals, or risk-based standards.

Olin Response to Comment 19

Discussion will be revised and supported by tabulated data.

EPA response to Olin Response to Comment 19

Acknowledged

20. Page 1-11, Section 1.3.7, 2nd paragraph: The Report shall refer to a figure that shows both the DAPL pools and their names as provided in the text, such as Figure 1.3-4. Figure 1.3-4 does not include an "Upper DAPL Pool." If this feature is used to describe the combined Off-Property and On-Property DAPL pools, it shall also be shown on a figure. If this term is used solely to describe the DAPL pools that are higher in elevation, recommend not capitalizing "Upper" and making it clear at the beginning of the second paragraph that the upper DAPL pool includes two pools.

Olin Response to Comment 20

Revisions will be made as requested.

EPA response to Olin Response to Comment 20

Acknowledged

21. Page 1-11, Section 1.3.7, 2nd paragraph. The text states "The majority of existing dissolved phase contaminants in groundwater resulted from convective mixing during initial migration of the DAPL while the facility was being operated. The mass flux of dissolved constituents through the diffuse layer is likely small in comparison to those initial releases from convective mixing." This assertion is not supported by any data in this section and shall be evaluated in the discussion of fate and transport. This statement shall be omitted from this section.

Olin Response to Comment 21

The statement will be moved to fate and transport discussion and literature cited.

EPA response to Olin Response to Comment 21

As noted in EPA's comment, the discussion of mass flux from the DAPL layer should be moved to the section dealing with fate and transport. However, the conclusion presented by Olin that the "mass flux of dissolved constituents through the diffuse layer is likely small in comparison to those initial

releases from convective mixing" must be supported by site specific data or deleted from the report. In addition, adjectives such as "small" are subjective and need to be qualified and supported by data. As currently drafted, the report implies that DAPL as a current ongoing source through mass flux is small. EPA does not agree with this conclusion. Moving the statement to a different section and adding a citation from literature, does not address EPA's original comment.

22. Page 1-11, Section 1.3.7, 3rd paragraph. The text indicates the presence of DAPL in weathered bedrock at well GW-43D. However, this well is not included within the area of the Off-PWD DAPL pool. The extent of the DAPL pool shown on the various figures shall be modified to include this location or the Report shall explain why this well is not included in the DAPL area.

Olin Response to Comment 22

The DAPL pools are defined by the volume of DAPL contained in the porous media above bedrock. The original GW-43D which was destroyed was partially screened in bedrock (assumed to be weathered) and based on historical data and interpretations contained DAPL. The replacement well GW-43DR was drilled to bedrock but the well installed was screened in overburden above bedrock and does not contain DAPL and therefore is not part of the DAPL pool. In addition, to include this well as part of the off-PWD pool would necessitate a volume that is substantially larger than current DAPL pilot results indicate. Olin shall explain in the revised OU3 RI why this well is not included in the DAPL area. The discussion provided in the Draft Focused DAPL RI shall also be included.

EPA response to Olin Response to Comment 22

The RI Reports should present a consistent discussion of the nature and extent of DAPL at the site. EPA understands that Olin has data to roughly define the area of DAPL in the overburden aquifer in the off-property area around Main Street Area and this area has been loosely defined as the Main Street DAPL Pool. However, EPA believes that there may also be a broader area (or pool) of DAPL contamination in the shallow bedrock near GW-43D and has requested that the extent of contamination in this area be better defined as part of the data gaps investigation. Therefore, figures that generally depict the extent of DAPL contamination should include the GW-43D area, not just those areas where current information suggests a pool of DAPL. The figures can include a note that the DAPL in the GW-43D area was found in shallow bedrock and that further investigation to determine the full extent in the shallow bedrock will be conducted as part of the data gaps investigation.

23. Page 1-11, Section 1.3.7, 5th paragraph. The text states that "The 20,600 µmhos/cm value was statistically derived by previous investigators as a threshold value…" A reference to the specific document that developed the DAPL threshold concentrations shall be provided and the Report shall include a summary of this evaluation.

Olin Response to Comment 23

The specific document will be referenced and summarized as requested. updated as requested previously.

EPA response to Olin Response to Comment 23

Acknowledged

24. Page 1-11, Section 1.3.7, 5th paragraph. The Report states that "NDMA concentrations in DAPL overlap with those found in overlying diffuse groundwater and therefore the concentration is not a reliable indicator of DAPL." The Report shall provide the analysis that supports this statement.

Olin Response to Comment 24

The Report shall provide the analysis requested.

EPA response to Olin Response to Comment 24

Acknowledged

25. Page 1-11, Section 1.3.7, 6th paragraph. The Report states that "diffusion results in the presence of a "Diffuse Layer" which is a three to five-foot thick layer of groundwater that overlies the DAPL, and is defined by specific conductance between 20,600 and 3,000 µmhos/cm." The Report shall provide support why 3,000 µmhos/cm was selected as the top of the "Diffuse Layer". Vertical profiles of the parameters shall be added as noted in previous comments. Diffusion of NDMA and ammonia, highly mobile parameters, has occurred well beyond 3-5 feet defined by the "diffuse Layer." Olin shall clarify in the Report that the term "Diffuse Layer" is limited to selected parameters and doesn't include NDMA and ammonia. The Report shall also include concentration contour maps for each of the contaminants of concern, including NDMA and ammonia, and these contours shall be compared to the boundaries of the DAPL material and the "Diffuse Layer" on new figures added to the report.

Olin Response to Comment 25

The report will review and update definitions of DAPL, diffuse and overlying groundwater. Draft contour figures were already submitted to USEPA.

EPA response to Olin Response to Comment 25

Acknowledged. The contour figures shall be included in the revised RI report and should include a contour for what will be defined as "the highly contaminated groundwater in the IAFS."

26. Page 1-12, Section 1.3.8. The Report shall add a reference to a figure showing the watershed divides.

Olin Response to Comment 26

The report shall reference Figure 1.2-1; Watersheds, DAPL Pools, and Site Features which was referenced in the previous section.

EPA response to Olin Response to Comment 26

The watershed divide is very flat and has been documented to shift substantially at time depending on hydraulic conditions. Olin shall provide a single figure that captures the full range of the divide at different periods including during the time period when the Samina and Town wells were actively pumping.

27. Page 1-12, Section 1.3.8, Watershed Divide. The Report states the location of the current watershed divide but fails to include a discussion of the data available when the municipal wells were pumping and discuss the location of the watershed divide when the municipal wells are pumping. A review of the historical data indicates that the water shed divide was likely located on the Site when the municipal wells were pumping. This information explains why most of the contamination is in the Ipswich watershed and not the Aberjona watershed. The figure the Interim Update Investigations, Smith, June 1996 provided information on the divide from October 1995. Additionally, the report titled "Olin Wilmington Technical Series XIV. A Groundwater Flow and Solute Transport Model April 2001 by Geomega" provided the groundwater information on the divide for April 1998. The revised RI Report shall include figures and information from these reports and discuss the impacts of the location of the divide on the extent of contamination.

Olin Response to Comment 27

The revised Report will include figures, information, and discussion regarding the groundwater divide as requested. The Sanmina wells (former Altron wells) were regularly pumping in excess of 150 gallons per minute (>200,000 gallons per day) during the time period cited. It was not the Town Wells that caused the apparent shift in the divide, but rather the Sanmina wells which were located on the divide, which caused a drawdown that extended over to the Olin property. Consequently, operation of those wells also pulled water from the Ipswich side, and likely pulled water from over the divide toward the Altron wells. When the groundwater Zone II evaluation was conducted, it did not show the zone of contribution of the Town Wells to be within the Olin property except in the vicinity of Plant B. The Geomega modeling report also shows the theoretical effect of pumping from the Sanmina wells.

EPA response to Olin Response to Comment 27

These details and data shall be included in the revised RI Report.

28. Page 1-14, Section 1.4.2.2, 3rd paragraph. The Report shall clarify whether the Tank 7 of the Plant B treatment system is the same as the Tank 7 that was part of the Plant B Tank Farm

Olin Response to Comment 28

Tank 7, the very large 150,000 gallon tank was originally used as a water supply surge tank in the early years of Plant operation. Tank 7 currently is used to store water in the Plant B treatment system.

EPA response to Olin Response to Comment 28

Acknowledged. The Report should include this discussion.

29. Page 1-16, Section 1.4.2.3, 3rd paragraph. Lake Poly has been identified as a primary source area and is of interest for the RI. The text notes that Lake Poly has been the subject of several investigations, as documented in the FRI (MACTEC, 2007), the OU1/OU2 RI (AMEC Foster Wheeler, 2015b), and in several MassDEP submittals. The Report shall provide references to the primary MassDEP submittals where this information can be found. The Report shall also include a detailed summary of the data and the conclusions from those investigations. The summary shall demonstrate with data the remaining contamination in these areas at the conclusion of the previous cleanup and whether the concentrations that remain pose a leaching threat to groundwater.

Olin Response to Comment 29

USEPA requested that Olin install a boring in Lake Poly to confirm the backfill as reported in earlier RAMs. Olin will include an investigation history from the OU1 RI in the OU3 RI. Data collected to date indicate Lake Poly soils have no residual leaching concern to groundwater. Groundwater data presented in the OU3 RI indicate Lake Poly is not a continuing source of contamination. Additional detail will be provided in the revised RI.

EPA response to Olin Response to Comment 29

Acknowledged, subject to review of the new text.

30. Page 1-16, last paragraph. Text states that 4,350 cy of soil were excavated, and 200 cy of soil were disposed. The Report shall describe in detail what happened to the remaining 4,150 cy of excavated soil.

Olin Response to Comment 30

The Report will provide the requested detail.

EPA response to Olin Response to Comment 30

Acknowledged. Olin shall include manifests and other records if available.

31. Page 1-17, Section 1.4.2.4. This section shall have a more complete discussion of the sewer and septic systems, as leaking piping may have been a significant source of contamination in addition to the various disposal lagoons and pits. The section refers to more detailed discussion from the OU1/OU2 RI (Amec Foster Wheeler, 2015b), but the details specifically pertinent to potential groundwater sources shall be added to the Report. These include piping schematics, description of piping construction (to the extent known), and a reference to a figure showing these features. Known or suspected leaks in process sewer lines (described in the last sentence of Section 1.4.2.3, 5th paragraph) shall also be included in this discussion.

Olin Response to Comment 31

There are no records of known or suspected leaks in the piping systems. Details provided in the OU1 OU2 RI Report concerning the sewer system and modifications will be repeated in the OU3 RI report.

EPA response to Olin Response to Comment 31

Acknowledged

32. Page 1-17, Section 1.4.2.4. States that additional description of the sanitary and septic systems at the facility are provided in the FRI (MACTEC, 2007) and the final OU1/OU2 RI Report (Amec Foster Wheeler, 2015b). Upon review of these documents, the descriptions of these systems are essentially the same. The Report shall only use one reference (such as the OU1/OU2 RI report) for clarity.

Olin Response to Comment 32

The Report will refer to the OU1 OU2 RI Report.

EPA response to Olin Response to Comment 32

Acknowledged

33. Page 2-5, Section 2.1.1.1, 7th paragraph. The statement. "…and subsequent responses to comments indicated that the slurry wall is functioning as intended and designed." EPA does not agree with this statement and it shall be deleted from the Report. The slurry wall was designed and constructed without EPA involvement. The goals of the intended design are unknown and not approved by EPA. The degree of containment achieved by the slurry wall is unclear. Groundwater monitoring data outside and just downgradient of the slurry wall indicate increasing concentrations in at least one downgradient well cluster (GW-202) which suggests that the slurry wall is not providing sufficient containment. An evaluation of water level measurements indicates that the slurry wall is not preventing groundwater flow into and out of the containment area. Groundwater flow is not limited to the equalization window as intended in the design. Rather, groundwater flow remains consistent with that outside of the slurry wall which demonstrates that the slurry wall is not providing sufficient containment (see detailed comments on the Draft OU1/OU2 FS Report). Furthermore, the Hydraulic Pulse Interference Test (HPIT) which was intended to assess the effectiveness of the slurry wall was inconclusive and found to not be a representative test for the unconfined aquifer conditions. The Report shall conclude that there are uncertainties associated with the effectiveness of the slurry wall at containing the source areas located on the Olin property. The Report shall also note that the wall does not extend beyond the property boundary and is therefore not effective at controlling the source areas located off the property.

Olin Response to Comment 33

The Report conclusions will not be altered at this time. EPA's basis for its position is a circular argument that has not provided any affirmative information on the performance of the Slurry Wall. USEPA's assertion that the Slurry Wall has defects and is not performing as intended is without any material basis.

Simply citing gradients within the Containment Area which has recharge inputs through the equalization window and leakage through the temporary cover is an insufficient basis to conclude that the Containment Area is the contributing source to adjacent groundwater impacts in the South Ditch. Olin believes that additional, limited investigation should and can be conducted to provide a more definitive position relative to slurry wall integrity. Related data gaps will be discussed during the January 2019 meeting.

In its approval of the RAM Completion Statement the in March 2005, which included construction of the Containment Area and temporary cap, MassDEP stated its belief that impacts to South Ditch surface water were not the result of leakage or failure of the containment system, but rather were from uncontrolled sources related to the DAPL in the off-PWD area. Olin concurs with that assessment.

EPA response to Olin Response to Comment 33

As noted in EPA's memorandum to Olin dated February 25, 2019, EPA believes there are several lines of evidence that raise uncertainty regarding the effectiveness of the slurry wall at providing the degree of containment needed to control the sources on the property. EPA also does not agree with the conclusion that impacts to the South Ditch surface water are solely from uncontrolled sources in the off-PWD area. As such, these statements should be deleted or supplemented with EPA's position.

As a general matter, MassDEP requested that the Olin site be placed on the NPL because MassDEP was not satisfied with the cleanup being conducted by Olin under the state program. Therefore, it is inappropriate to imply that state approval of certain actions, documents or positions constitutes sufficient response to EPA's comments.

34. Page 2-13, Section 2.1.2.10, 4th paragraph. The reference to Section 1.3.2 is not correct. The reference shall be revised to Section 1.3.7.

Olin Response to Comment 34

The reference will be checked and corrected as needed.

EPA response to Olin Response to Comment 34

Acknowledged

35. Page 2-20, Section 2.2.3. The text indicates that Table 2.2-2 lists wells proposed to be included in May and October 2011 synoptic water level rounds and a rationale for wells proposed but not measured. There does not appear to be any indication in Table 2.2-2 as to which wells were not monitored or why they were not monitored. Table 2.2-2 shall be updated to include this information.

Olin Response to Comment 35

Appropriate discussion will be added to text or the table. During synoptic rounds some well were not accessible due to access or physical well conditions (wells that were destroyed or had physical obstructions such as dense mouse nests).

EPA response to Olin Response to Comment 35

Acknowledged

36. Page 2-21, Section 2.2.2, 8th paragraph. In the last sentence, "after discussion with USEPA" shall be deleted.

Olin Response to Comment 36

The change will be made if documentation of the discussion cannot be produced.

EPA response to Olin Response to Comment 36

Acknowledged

37. Page 2-23, Section 2.2.4, 5th paragraph. This section mentions clogging of the second lowest port in one of the multi-level monitoring wells. EPA was not aware of any clogging during the tests. The Report shall provide supporting data.

Olin Response to Comment 37

Olin has provided updates of the progress of the DAPL extraction efforts since the submittal of the DAPL Pilot Final Report. ML2 port 2 was last sampled on 3/9/2017. Since 5/30/2017 this port has been clogged and cannot be sampled. This is indicated in the data plots. Currently port 2 is located within diffuse groundwater above the DAPL interface which resides between ports 1 and 2.

EPA response to Olin Response to Comment 37

A comprehensive summary of the voluntary pumping effort, with data, shall be included in the revised RI report. In addition, Olin shall present a plan for clearing the clogged port or adding another monitoring port to collect data from this level.

38. Page 2-23, Section 2.2.4, last paragraph. The RI Report shall include all performance monitoring and volume data collected during the voluntary operation of the DAPL extraction system (November 2015 through June 2018).

Olin Response to Comment 38

On a periodic basis on request from USEPA, Olin provided all data in an excel electronic format. In the Draft Focused DAPL RI/FS Olin updated volumetric calculation of DAPL extracted and DAPL remaining. In the revised RI Report, Olin will again provide this analysis and data.

EPA response to Olin Response to Comment 38

Acknowledged. The RI report should be a stand-alone document. Please also note that additional data shall be collected as part of the data gaps investigation to better define the volume of DAPL present in all

pools. As noted in previous comments, measurements from one monitoring well location is not sufficient to understand changes in volume over the larger DAPL pool area.

39. Page 2-23, Section 2.2.4, last paragraph. Olin was, until recently, operating the Pilot well at 0.25 gpm, stating operating issues when operating at 0.5 gpm. The Report shall provide the data and other information collected during operation that lead to the conclusion to reduce the pumping rate to 0.25 gpm, and subsequently to suspend operation at 0.25 gpm.

Olin Response to Comment 39

Olin typically operates the system until the point when EW-1 extracted DAPL has a specific conductivity of less than 60,000 mS/cm and the extracted fluid is pale green in color. DAPL specific conductance should be in the range of >80,000 mS/cm and color of dark green to almost black. USEPA should recall that Olin's original design called for a shorter two foot screen, but Olin was required to put in a longer screen based on comments from MassDEP in 2004/2005 and the USEPA ORD ADA Oklahoma National Risk Management Research Laboratory. This screen length now impacts the DAPL quality being recovered since the screen is now spanning the remaining DAPL column and is subject to intrusion of overlying groundwater even at low pumping rates. Also the bottom of the OPWD pool has a shallow slope so gravity drainage rates are declining. The system is restarted when EW-1 and adjacent ML ports (Port 1) recover and ports at MP-2 indicated the DAPL interface has once again stabilized. This data is apparent in the graphs provided to USEPA by Olin and as described in memoranda. The revised RI report will transmit this data as requested in an Appendix.

EPA response to Olin Response to Comment 39

Please use consistent units to express specific conductance. Previous reports list values as micro-ohms per cm (µmhos/cm). They specify that DAPL generally has a specific conductance of greater than or equal to 20,600 µmhos/cm. 1 mS/cm = 1 µmhos/cm, so EPA doesn't understand why such a high conductivity value, 60,000 mS/cm or nearly 3x the value for DAPL, is being used as a trigger to shut down. Discussions regarding screen length shall be part of the technologies review and alternatives evaluation in the pending IAFS.

40. Page 2-24, Section 2.2.5, 3rd paragraph. The Report states: The HPIT Final Evaluation Report (Amec Foster Wheeler, 2016) that included GeoSierra's Phase II HPIT Report concluded that: 1) A very consistent and stable hydrogeologic condition exists that is dominated by the presence of a vertical hydraulic barrier (e.g., the slurry wall) that diverts groundwater around the Containment Area, and isolates the groundwater within, and 2) that the slurry wall associated with the Containment Area continues to serve its intended purpose and be structurally sound. These statements are not true and shall be deleted from the Report. The conclusion from the HPIT Final Evaluation Report was that HPIT could not determine the adequacy of the slurry wall. Additionally, page 5 of the HPIT Final Evaluation Report states that "the results of test well pair GW-6D to GW-CA3D deserves additional discussion." This statement supports the fact that there may be another plausible explanation for the data. EPA believes that the pressure pulse observed between these two wells was likely transmitted under the wall rather than through it especially considering that the slurry wall is not keyed into the bedrock.

This conclusion is further supported by an evaluation of the water surface elevation data collected inside the containment area since 2013. An evaluation of this data indicates that the outside water surface elevations have a significant influence on the interior water surface elevations. This indicates that flow is occurring into and out of the containment area either through the slurry wall, through the slurry wall/bedrock interface, through weathered bedrock under the slurry wall, or through bedrock fractures. The Report shall be revised to include this analysis and shall conclude that there is considerable uncertainty associated with the effectiveness of the slurry wall at containing contamination in this area.

Olin Response to Comment 40

Olin cannot replace its conclusions regarding slurry wall effectiveness with assertions made by USEPA with no credible supporting evidence, nor can Olin acknowledge "considerable uncertainty" as we do not believe there is considerable uncertainty However, Olin recognizes that additional information appears to be required to demonstrate our position to USEPA. Methodology to close this apparent data gap will be discussed during the January 2019 meeting. Olin has always contended the initial pulse in that well pair was likely through weathered bedrock under the Slurry Wall. Olin also noted that the gradient at this location is inward precluding movement of groundwater from within to outside the Slurry Wall. Olin attempted to but could not replicate this test result.

USEPA's assertion that this one test result that could not be replicated on an upgradient section of the Slurry Wall constitutes a basis to assert considerable uncertainty in the effectiveness of the entire slurry wall is unsupported and overreaching in its conclusion.

Olin again notes that the MassDEP in its March 29, 2005 approval letter of the Construction RAM Completion Certification concluded that impacts to South Ditch were not the result of leakage or failure of the containment system but attributed these impacts to uncontrolled impacts to upgradient groundwater in the off-PWD area where the DAPL pilot is ongoing.

EPA response to Olin Response to Comment 40

As discussed previously, the Draft RI Report shall contain EPA's position whether Olin agrees with it or not. EPA has presented several lines of evidence that support the conclusion that there is uncertainty as to the overall effectiveness of the slurry wall as the sole means to control the sources within the system. The lines of evidence are not solely related to the contamination in South Ditch. There are other lines of evidence that suggest possible ongoing releases from the system. EPA also believes that there is sufficient data to support the need to evaluate as part of the FS certain additional actions to supplement the slurry wall and improve its effectiveness at containment. EPA requests that all lines of evidence be presented and discussed and that the FS evaluate an appropriate range of alternatives to supplement the current system.

Please see also EPA's Response to Olin's Response to Comment 33 regarding EPA's position on state approval of documents, actions or positions for work conducted prior to CERCLA listing.

41. Page 2-24, Section 2.2.5, 3rd paragraph. The statement "The USEPA accepted Olin's recommendation of no further testing related to the slurry wall" shall be deleted from the Report.

Olin Response to Comment 41

Olin will delete the statement and insert a statement that EPA approved the Report which contained that recommendation.

EPA response to Olin Response to Comment 41

EPA has no record of ever approving the Phase II HPIT Final Report In addition, a recommendation that further testing is not needed at a specific point in time does not imply approval of other conclusions related to the effectiveness of such a system.

42. Page 2-24, Section 2.2.7, 2nd paragraph. The Report shall include the total number of private wells sampled since 2008.

Olin Response to Comment 42

The requested information will be provided.

EPA response to Olin Response to Comment 42

Acknowledged

43. Page 3-3, Section 3.2.1, 2nd paragraph. The text states that discussion of the shallow overburden materials (concrete slabs, fill, organic/peat deposits) have been omitted because they have no bearing on OU3. This statement is incorrect. The extent and rate of recharge to the subsurface (and therefore both groundwater and contamination flow) is controlled by the relative permeability of the shallow overburden materials. In addition, near surface organic deposits may serve as important sinks for contamination that may be carried downward with recharge from precipitation. Discussion of the shallow overburden materials and how they may inhibit or enhance recharge and therefore groundwater flow patterns shall be added to the Report.

Olin Response to Comment 43

The requested discussion will be provided. Note Olin drilled through the slabs at the request of USEPA under OU1 and reported the data in the OU1/OU2 RI report and found no additional soil sources.

EPA response to Olin Response to Comment 43

Acknowledged

44. Page 3-5, Section 3.2.2, 2nd and 3rd paragraphs. EPA had requested a north-south cross-section to evaluate potential source areas. The cross-section provided is focused on the immediate vicinity of the former Lake Poly and reproduces a figure originally provided in the OU1/OU2 RI (Figure 3.2-2). The Report shall address the soils, bedrock, and potential groundwater pathways from the Lake Poly

source area to the DAPL pools. The other cross-section lines provided are perpendicular and significantly west of this area. The Report shall include the following to evaluate the groundwater conditions associated with the original source area and to evaluate groundwater conditions in the areas of high NDMA concentrations north and southeast of the Olin property (see attached mark-up):

a. Extend cross-section A-A' to the north to incorporate data from the GW-400 cluster.

b. Extend cross-section A-A' to the southeast to incorporate the upper DAPL pools and

the following wells (in order from the current southern end of the cross-section): GW76S, GW-CA1/GW-CA2/GW-36, MP-1, GW-79S/PZ-16RR, PZ-18, GW-50S/D, and GW-49D/GW-80BR/D/S.

c. Extend cross-section B-B' to the east to incorporate data from the GW-413 cluster. d. Extend the Lake Poly cross-section to the north to incorporate data from GW-302, GW-301, GW-31S/D, the GW-413 cluster, and GW-415D (from south to north). If a borehole is installed to the west of the GW-413 cluster, this may replace that cluster.

e. Extend the Lake Poly cross-section to the south to incorporate DAPL pool information,

including the following (from north to south): GW-35S/D, GW-30DR/PW-2, GW202S/D/BRS/BRD, and GW-39.

Olin Response to Comment 44

These Sections have been completed and will be provided to USEPA prior to the revised RI.

EPA response to Olin Response to Comment 44

Acknowledged

45. Page, 3-10, Section 3.3. The Report shall calculate and tabulate groundwater flow rates based on representative hydraulic conductivities and gradients at multiple depths and in different areas of the Site, taking into account the ranges of geologic material encountered, and include this information in the text or in a table as appropriate. If site-specific hydraulic conductivities are not available, the Report shall explain the reasoning for selecting representative values. This information is critical to evaluate potential contaminant migration rates.

Olin Response to Comment 45

The requested calculations will be performed and presented as requested.

EPA response to Olin Response to Comment 45

Acknowledged

46. Page, 3-13, Section 3.4. The discussion of bedrock hydrogeology shall be expanded to include the following topics:

a. Discussion of hydraulic conductivities measured in bedrock in different areas (not just a single borehole). Note that Table 3.3-2 lists hydraulic conductivity values for MW202BR, MW-203BR, MW-204BR, and MW-206BR.

b. Calculation of an estimated range of bulk (large-scale) groundwater flow rates based on gradients and hydraulic conductivities.

c. Evaluation of the potential for fracture interconnection and groundwater transport. While bedrock groundwater flow is through individual fractures, several bedrock boreholes have extremely large fractures and fractured zones. The Report shall discuss the implications of these significantly fractured zones.

d. Presence and thickness of a weathered bedrock zone at the top of bedrock.

e. The elevation differences between bedrock boreholes do not suggest that groundwater will necessarily flow from high to low head, because bedrock groundwater flow is generally restricted to fractures. However, they do indicate potential for groundwater flow, and on a sufficiently large scale, may be appropriate to indicate groundwater flow. The Report shall include bedrock groundwater contour maps and discuss the potential for bedrock groundwater flow, and how the fracture regime may impact this potential for flow.

f. Evaluation of the potential for groundwater flow in bedrock near the bedrock DAPL pools and other areas of DAPL.

g. Section 5.2, 1st paragraph suggests that bedrock flow directions mimic deep overburden groundwater flow because the two systems are connected. Where competent bedrock exists, the systems may not be connected to a significant degree. The discussion of bedrock flow shall address the potential connection between aquifers.

h. The Report shall discuss the expected fracture regime in the vicinity of Cook Ave, and describe both the quantity and quality of hydrogeologic data available to determine the potential bedrock migration pathways in this area.

Olin Response to Comment 46

For comments "a" through "g", Olin will provide descriptive analysis. Note that slug testing, though commonly performed in bedrock wells, is not valid since fractured media is not a porous media and Darcy's law is not applicable to fractured media, so the methods are approximations of properties and not a measure of fracture conductivity.

For comment "h", data from GW-405BR will once again be discussed as this is the only well with oriented fracture data in the area. This discussion will also include insights from geochemistry which perhaps is more important that fracture orientation.

EPA response to Olin Response to Comment 46

Acknowledged. With regard to slug testing, there are other methods to collect hydraulic conductivity data (pumping tests, packer tests, FLUTe transmissivity tests) and these shall be considered during future bedrock investigations. GW-81BR and GW-202 BRS/BRD shall also be included in this discussion.

47. Page, 3-13, Section 3.5. Maple Meadow Brook and Sawmill Brook. This section shall be revised to include a discussion of the potential impacts of shallow groundwater on both Brooks. While most of the shallow groundwater samples in the Maple Meadow Brook Watershed (MMBW) have been non-detect for NDMA, elevated concentrations of NDMA in shallow groundwater have been detected at GW-83S, GW-82S, and potentially upgradient (GW-58S). The limited NDMA data from GW-83S also indicates that concentrations have increased over time. This shallow groundwater has the potential to migrate upward and impact the MMBW, and therefore the surface water bodies associated with it. The Report shall be revised to include a comprehensive discussion of these potential impacts.

Olin Response to Comment 47

Twenty to thirty feet of peat deposits underlie the surface water system. The OU 2 RI concluded there were no surface water impacts from shallow groundwater. The reader will be referred to the OU2 Report.

EPA response to Olin Response to Comment 47

Acknowledged, except that specific relevant language from the OU2 RI Report shall be included in the revised OU3 RI Report.

48. Page 3-16, Section 3.6, 4th paragraph. The statement "Overall, the cessation of pumping from the municipal wells had no major impact on the groundwater divide observed near the site" is not supported by data in the Report. The Report shall include data and figures that demonstrate this conclusion. The data and figures shall include water level measurements taken before and after the use of these wells and shall include figures showing the location of the divide based on these measurements. All available data, including data from October 1995, shall be included in the analysis. In addition, rather than including a subjective statement like "major," the Report shall just reference the figures as a demonstration of the magnitude of the impact.

Olin Response to Comment 48

Olin will provide the data and figures, as appropriate, to demonstrate its position relative to the referenced statement.

EPA response to Olin Response to Comment 48

Acknowledged

49. Page, 3-16, Section 3.7. This section shall discuss MassDEP's Groundwater Use and Value determination for the Site as prepared in September 2010. The Report shall discuss the results of MassDEP's evaluation and the regulatory context of the groundwater use and value process with regard to evaluating potential groundwater use at a CERCLA site. The Report shall note that as part of the use and value determination, MassDEP requested that groundwater risks, including human health risk associated with active and potential drinking water of the Site groundwater, be evaluated. Section 6.0 of the RI Report shall be corrected to summarize the requested risk assessment.

Olin Response to Comment 49

In the December 10, 2018 meeting MassDEP clarified it's position relative to value and use of groundwater within the Aberjona watershed away from the area noted by Olin as potentially contributing to impacts observed in private wells located on Cook Avenue. Olin will work with USEPA and MassDEP to arrive at a consensus on appropriate language regarding these issues.

EPA response to Olin Response to Comment 49

Acknowledged, subject to EPA review of the revised text.

50. Page 3-5, Section 3.2.2, and Page 3-7, Section 3.2.3. The Report shall include a note indicating the vertical exaggeration on the cross-sections included on Figures 3.2-5 and 3.2-6.

Olin Response to Comment 50

The cross sections contain a note on vertical exaggeration which is for the convenience of presenting vertical detail in a manner that does not intentionally alter three dimensional relationships.

EPA response to Olin Response to Comment 50

EPA revisited Sections 3.2.2 and 3.2.3; and Figures 3.2-5 and 3.2-6. No notes indicating vertical exaggeration are present. Please provide in the revised Report.

51. Page 3-10, Section 3.3. There is an absence of data with which to fully evaluate groundwater flow in the vicinity of the Site. Potentiometric maps are included for the May and October 2011 synoptic water level rounds; however, numerous monitoring wells were not included in these rounds (as indicated by the "NG" in Table 3.3-1). Some of the wells not gauged in 2011 were included in a December 3, 2015 synoptic water level round; however, potentiometric maps of the 2015 data are not included. The Report shall include potentiometric maps of the 2015 water level data for shallow overburden, deep overburden and bedrock monitoring wells.

Olin Response to Comment 51

The wells gauged were the wells approved in the RI/FS work plan. As the work has evolved additional wells have been added. The revised Report will include available potentiometric maps.

EPA response to Olin Response to Comment 51

Acknowledged

52. The Report shall include hydrographs of water level data for all locations. Data from wells within a cluster shall be plotted on a single hydrograph so that vertical hydraulic gradients over time can be evaluated. The Report shall include water level data collected when the public water supply wells were active as well as more recent data.

Olin Response to Comment 52

This is an excessive request that will provide little value to the report. There are well over 200 monitoring locations that would apply to this request. Olin will be happy to again provide all water level data in its possession to USEPA, which it has done the past when it provided its data base to USEPA. Producing graphs of water levels in each and every well is a laborious task which is unnecessary and provides little benefit.

EPA response to Olin Response to Comment 52

This is not an excessive request. Hydrographs are routinely provided in remedial investigation reports. Given the complexity of the hydraulic setting of this study area, and in the context of the recent disagreements between EPA and Olin regarding the conceptual site model, this is information is crucial to furthering the factual understanding of groundwater migration pathways. The RI report is intended to be a stand-alone document. Raw water level data contained in tabular format does not provide the analysis of the data expected in a remedial investigation report. Accordingly, Olin shall provide the requested hydrographs.

53. The Report shall include figure(s) posting the vertical hydraulic gradient at each well cluster, include gradients between shallow and deep overburden, and between deep overburden and bedrock, at a minimum.

Olin Response to Comment 53

Olin shall provide tables with the requested data. This is a more efficient way to convey the same data.

EPA response to Olin Response to Comment 53

While more efficient, display of this information on figures is more effective. Accordingly, Olin shall provide figures with vertical gradient information.

54. The Report shall include potentiometric cross-sections and expand the discussion of vertical hydraulic gradients, particularly focusing on areas near DAPL. The Report shall include potentiometric maps that represent conditions that existed when the public water supply wells were pumping.

Olin Response to Comment 54

Olin will provide additional requested potentiometric information and analysis. USEPA is possession off all available potentiometric maps in Olin's possession that existed when the public water supply wells were pumping. As a resource to the RI Olin will again provide the Smith Phase II Report which contains all these requested data. Olin has provided this to USEPA previously on at least two occasions.

EPA response to Olin Response to Comment 54

Acknowledged. The RI is intended to be a stand-alone document to support a subsequent decision-making. As such, references to and inclusion of whole-sale information contained in previous reports is

not conducive to review of the pertinent information. Pertinent information shall be included in the body of the Report. Alternatively, specific references (i.e., table, figure, section or page number) may be acceptable in limited circumstances.

55. Table 3.3-5 is a summary of vertical hydraulic gradients but it does not include any bedrock monitoring wells. This table shall be expanded to include, at a minimum, all well clusters with bedrock monitoring wells. Vertical hydraulic gradients shall be calculated for multiple monitoring dates so that average gradients can be calculated and changes over time can be evaluated. The Report shall include water level data collected when the public water supply wells were active, as well as more recent data.

Olin Response to Comment 55

The table will be expanded to provide requested information. Water level data available from when the Town Wells were in operation is not in tabular form, but is presented in potentiometric maps.

EPA response to Olin Response to Comment 55

Acknowledged.

56. Sections 3.7 and 4.1 of the RI Report discuss groundwater use classifications. The Report shall be revised to, at a minimum, include figures showing the location of these areas relative to the Site. The Report shall also be revised to add figure(s) showing these areas relative to the groundwater contamination.

Olin Response to Comment 56

Groundwater classification overlays will be provided on the extent of groundwater impacts on a figure.

EPA response to Olin Response to Comment 56

Acknowledged.

57. Page 4-1, Section 4.1. The second paragraph in this section shall be deleted from the Report. This section shall summarize MassDEP's Groundwater Use and Value determination for the Site as prepared in September 2010.

Olin Response to Comment 57

It is clear based on the December 11, 2018 meeting that MassDEP is willing to discuss the groundwater use and valuation. Olin and MassDEP will work through mutually acceptable language on this topic for inclusion in the revised RI .

EPA response to Olin Response to Comment 57

Acknowledged, subject to review of the revised language. Note the meeting was December 10, 2018.

58. Page 4-1, Section 4.1.2. The references to the MCP's definitions of "Current Drinking Water Source Area," "Potential Drinking Water Source Area," and "Potentially Productive Aquifer" shall be deleted from the Report.

Olin Response to Comment 58

These are statutory definitions pertinent to the Site and the RI and will not be deleted. As noted above, Olin will work with USEPA and MassDEP to develop appropriate language to include in the RI given clarifications received from MassDEP during the December 10, 2018 meeting.

EPA response to Olin Response to Comment 58

These statutory definitions are not considered to be ARARs under CERCLA, and therefore have no regulatory significance. Olin shall remove this discussion from the Report. However, EPA will consider any revised text.

59. Page, 4-2, Section 4.1.3. The reference to the MCP's definition of "Non-Potential Drinking Water Source Area" shall be deleted from the Report. The referenced sections of the MCP are not ARARs under CERCLA and refer to the potential to develop public water supply distribution systems. It does not prevent the potential installation of private water supply wells within the portions of the Aberjona watershed that are within the Site study area. The Report shall be corrected by deleting or revising the language to make it factually correct.

Olin Response to Comment 59

These discussions will be modified in accordance with discussions with MassDEP but not deleted.

EPA response to Olin Response to Comment 59

Acknowledged, subject to review of the revised text.

60. Page 4-4, Section 4.2.3. Although NDMA formation could not be replicated in a lab setting, the Report shall identify possible sources of NDMA. The Report shall also discuss any trends in the concentration of NDMA over time in the aquifer.

Olin Response to Comment 60

Olin has been consistently been clear that the origin of NDMA is unknown. As new groundwater data is collected. observations on changes in NDMA distribution will be provided, though the word trend will only be used if statistically acceptable tests have been conducted to allow trends to be demonstrated within a statistically significant probability.

EPA response to Olin Response to Comment 60

The origin of NDMA is not "unknown." Although there is no record of NDMA use in former manufacturing processes at the site. Olin's former studies include an evaluation of precursors and conditions that may have resulted in the formation of NDMA either during manufacturing, discharge, or in-situ in the aquifer. These studies concluded that the NDMA was most likely formed in-situ through

either "nitrosation" or "monochlroramine." The studies all but dismissed formation during the manufacturing processes because favorable conditions for the formation of NDMA occurred during a period where effluent discharge was to the municipal sewer system (Part I, Phase II Supplemental CRAM, MassDEP, 2003). These conclusions were further validated by EPA's Office of Research and Development (G. Wayne Sovocool, Ph. D., 2012). The revised Report must be clear that studies to date indicate that the NDMA formed in-situ from the discharge of precursor chemicals and into a favorable environment. The Report shall then the discuss the potential for continued NDMA formation given the current precursor concentrations and aquifer conditions. If additional field and lab studies are required to opine on the efficacy of continued NDMA formation, this is a data gap which shall be addressed through the pending OU3 work plan.

61. Page 4-4, Section 4.2.3, Location and volume of DAPL. The Report discusses the location and volume estimates of the DAPL pools, but the Report does not appear to include supporting data. The Report shall explain how the DAPL pools were delineated and include the monitoring data used to delineate them. The Report shall explain how the DAPL volumes were estimated, and include the calculations and data used to estimate the DAPL volumes.

Olin Response to Comment 61

This data was contained in prior RI/FS reports requested for DAPL. The volumetric calculations are based on 3D digital elevation models of the DAPL pools and will be provided.

EPA response to Olin Response to Comment 61

Acknowledged. The RI is supposed to be a stand-alone document.

62. Page, 4-4, Section 4.3.1. This section requires additional detail. Specifically, the Report shall include a list of the wells included in the RI/FS work plan that were to be sampled, but were not sampled and why (i.e., not located, located but damaged, or located but dry). Also, this section shall describe the sampling and results for 1,4-dioxane conducted according to the approved workplan.

Olin Response to Comment 62

The requested information will be provided. 1,4 dioxane was not an analyte in the approved RI/FS work plan and no request to sample for 1,4-dioxane otherwise has been received by Olin.

EPA response to Olin Response to Comment 62

1,4-dioxane was added and sampled from a limited set of wells during the RI field work. Results are reported in the draft RI Report. It was detected in only 1 of the 54 samples. Please update the report as requested.

63. Page, 4-5, Section 4.3.2. This section shall provide the final list of contaminants of concern for discussion of contaminant nature and extent. This section shall also describe the selection criteria for selecting contaminants of concern based on exceedances of screening criteria and frequency of

detection. While Section 4.3.2 does describe fuel-related compounds and chlorinated solvents as being related to other properties, it does not list the specific compounds that are screened out based on this evaluation, which it shall be revised to do. For comparison, we have highlighted potential contaminants of interest based on frequency of detection and exceedances of MCLs/SMCLs or residential tap water RSLs if MCL/SMCLs were not available (see table in Appendix 1 - Attachment 2). The text shall be revised accordingly.

Olin Response to Comment 63

An RI Report does not select COCs. The BHHRA selects COPCs. Since USEPA requested that the RI, BHHRA and FS be prepared concurrently, the RI presented distribution figures for constituents that the BHHRA determined to be COPCs based on USEPA risk assessment guidance. Olin will describe the selection criteria for COPCs as requested.

EPA response to Olin Response to Comment 63

Please see page 53 of the June 2007 RI/FS SOW for the Site. Step one of the human health risk assessment is Hazard Identification. This step clearly states that it includes an identification of the "contaminants of concern" upon which the quantitative assessment of risk will be based. The human health risk assessment is included as Section 6.0 of the RI. That being said, the use of COPCs is acceptable as long as this terminology is defined and used consistently in the report.

64. Page, 4-6, Section 4.4. The data depictions in the Section 4.4 contaminant maps are based on a statistical comparison to the results for each figure. Therefore, it is difficult to compare figures for different depths for the same contaminant. For example, the maximum sulfate concentration in deep overburden is almost an order of magnitude above that of bedrock and the TMP1P maximum concentration in shallow overburden is more than an order of magnitude above that of bedrock. The Report shall be revised to use the same symbol weighting for all three depths for a given contaminant to facilitate comparison.

Olin Response to Comment 64

Olin agreed with USEPA previously as part of the OU3 data gaps evaluation in 2014/2015 to use the Jenks Natural Break Symbology to portray the differences in concentrations between the various depth intervals that have been monitored. Making wholesale changes to how these figures are drawn will be costly. As such, Olin proposes to retain the Jenks Natural Break symbology but in addition will provide contours of the results based on MCLs, RSLs, and SMCLs in that hierarchal order. For example, if an MCL exists, it will be used to contour data in order of magnitude increments. If an MCL does not exist the RSL will be used, so on and so forth.

With this approach Olin will limit the need for written discussion of analyte distribution and let the figures speak for themselves. Olin will highlight which contaminants and contaminant sources are not Site related in text. Olin will eliminate extensive qualitative discussions of distributions of analytes that used such wording as low, moderate and elevated concentrations. When new data is collected, the RI will be updated by developing additional contoured distribution figures for each analyte and provide those figures in an appendix.

EPA response to Olin Response to Comment 64

Acknowledged, the addition of concentration contours and related discussion should facilitate comparisons.

65. Page, 4-6, Section 4.4. In addition to the listed contaminants of concern ("COCs"), dibenz(a,h)anthracene exceeds the tap water RSL in more than 5% of samples analyzed. PAHs have also been identified at concentrations above background in OU1 soils. The Report shall be revised to add contaminant distribution maps for PAHs (or a single representative PAH) and add a discussion of their distribution.

Olin Response to Comment 65

The PAH dibenz(a,h)anthracene is mobile in groundwater. Low level PAH analysis had considerable blank contamination issues in groundwater analysis including from residential wells from that same time period. Olin will provide a distribution figure for dibenz(a,h)anthracene but the suggestion by USEPA that PAHs are a site contaminant is not supported. At best, that PAHS are present in groundwater should be considered an anthropogenic commercial industrial background issue.

EPA response to Olin Response to Comment 65

Acknowledged that Olin will provide a distribution figure for dibenz(a,h)anthracene. PAHs are present in on-property soil above background. Therefore, EPA concludes that the PAHs in groundwater are site-related and not representative of an anthropogenic commercial industrial background compound.

66. Page, 4-6, Section 4.4, 1st paragraph. This paragraph shall be revised to state that the target analyte list was greatly expanded under the CERCLA program to address compounds identified as COCs under CERCLA guidance. The text shall also state that the RI included two rounds of data collection from each available well. In addition, the text shall state that additional rounds of data were also collected from a sub-set of the wells which are used to monitor Plant B, the containment area and the DAPL pilot under the IRSWP. The Report shall be revised to reflect this work.

Olin Response to Comment 66

The requested additions shall be included with the exception that the workplan did not identify COCs.

EPA response to Olin Response to Comment 66

Acknowledged. The work plan identified these compounds as the target analyte list or TAL.

67. Page 4-6, Section 4.4, 5th paragraph. In the informal comments provided on the Focused RI Report, as well as in the technical meetings conducted this past fall and winter, EPA clarified its expectation that iso-contour figures (more commonly referred to as "plume maps") shall be presented in the Report to display the extent of NDMA and other key parameters in groundwater. The Report shall be revised to

include plume maps (with concentration contours) for each COC for shallow, deep overburden, shallow bedrock and deep bedrock.

Olin Response to Comment 67

These figures have already been presented to USEPA in draft form.

EPA response to Olin Response to Comment 67

Acknowledged. These figures shall also be included in the pending source control RI for OU3.

68. Page 4-7, Section 4.4.1. Based on a review of Figures 4.4.1-1a/b/c, it is not clear how the boundary of potential impacts on the east side of the Site was determined. Figure 4.4.1-1b showing deep overburden groundwater has wells along the east side of the site (GW-32D, GW-52D, GW-307, GW-3D, GW-51D, GW-4D, GW-50D and GW-80D) with detections of NDMA ranging from 22 to 1300 ng/l of NDMA. Figure 4.4.1-1c showing bedrock groundwater only has two bedrock wells on the east side, GW-413BR and GW-80BR, which have concentrations around 130 and 97 respectively. The "Extent of Impacts" boundary is drawn along the property line on the east side of the property. However, there are no wells on the east side with non- detects of NDMA to indicate that the line is correct. Also, for bedrock wells, Figure 4.4.1-1c, the "Extent of Impacts" boundary for NDMA shall be extended to include the private wells that have had detects of NDMA. The Report shall be revised to show the proper boundaries for the extent of contamination. If data is lacking to complete the figures correctly, this issue shall be noted in the Report.

Olin Response to Comment 68

Lower East Ditch is a point of groundwater discharge with groundwater flowing locally toward it from the east and west. Deep overburden wells installed to bedrock on the east Side of East Ditch are not impacted (GW401, GW,402 and GW403). The referenced figures were drawn to indicate that the East Ditch provides a natural hydraulic barrier to migration eastward from the Site. The distribution of contaminants depicted is proper based on available information.

EPA response to Olin Response to Comment 68

Bedrock flow would not be influenced by the East Ditch. GW-414BR provides a non-detect boundary to the south, however more data points may be needed to the east and northeast to bound the bedrock. Based on the current data, Figure 4.4.1-1c for bedrock should be open along most of the East Side.

69. Section 4.4. The Report shall be revised to indicate the time period the data used to generate the Figure 4.4 series (showing nature and extent of contamination) covers. The Report shall indicate what data, if any, are excluded. Figure 4.4.1-1c indicates NDMA detection in approximately half of the groundwater samples collected in the vicinity of the Mill Brook Country Day School. The Report shall provide the data and discuss concentration trends.

Olin Response to Comment 69

The Report will be revised as requested.

EPA response to Olin Response to Comment 69

Acknowledged

70. Page 4-7, Section 4.4. It is unclear how Olin selected the criteria for "low", "moderate" and "elevated." These adjectives are subjective and don't provide an accurate factual context to the data. For example, for NDMA, Olin defines the "low" range as 0.42 to 31 ng/l. The upper end of this range is well above the tap water RSL of 11 ng/l. The statements using these terms shall be deleted from the Report and replaced with a discussion of how the data compares to MCLs, RSLs, or risk-based standards.

Olin Response to Comment 70

The low, moderate and elevated terminology was tied to the data bins presented in the legend as discussed in text. In future revisions of the RI, this qualitative description will be excluded in lieu of figures contoured to MCLs, RSLs,, SMCLs or other criteria. The RI report will include a limited narrative description of nature and extent including where constituents detected are not Site related and have other sources.

EPA response to Olin Response to Comment 70

Acknowledged

71. Page 4-7, Section 4.4. COCs. Neither the BHHRA nor the RI Report discuss the specifics of each of the COCs including NDMA. The Report, and the BHHRA, shall be revised to include a summary of the physical and chemical properties, as well as MCLs, other ARAR cleanup goals, or risk-based standards for all COCs.

Olin Response to Comment 71

An RI Report does not determine COCs. The Report will be revised to include the requested summary for constituents to be monitored as per the RI/FS work plan. MCLs, RSLs and other criteria are listed in the summary tables for analytes detected. Currently summary Tables 4.4-1 through 4.4-10 list the number of instances detected analytes exceed an MCL or RSL. The FS addresses cleanup goals for COPCs.

EPA response to Olin Response to Comment 71

Please see page 53 of the June 2007 RI/FS SOW for the Site. Step one of the human health risk assessment is Hazard Identification. This step clearly states that it includes an identification of the "contaminants of concern" upon which the quantitative assessment of risk will be based. The human health risk assessment is included as Section 6.0 of the RI.

72. Page 4-30, Section 4.4.5. Even though a particular metal is naturally present in an aquifer matrix, if Site-related contamination caused a geochemical change allowing for increased dissolution in groundwater, these metals must be addressed in groundwater. The Report shall be revised to include such metals as COCs.

Olin Response to Comment 72

Metals to be monitored as per the RI will be discussed in relation to potential REDOX interactions as described in the comment. Again, to note, an RI does not determine COCs under the CERCLA process.

EPA response to Olin Response to Comment 72

Arsenic and any other metals being mobilized by the geochemical conditions at the Site shall be considered as COPCs.

73. Page 4-34, Section 4.4.5.3. The text states that hexavalent chromium was detected inconsistently and that these concentrations are considered false positives. However, the hexavalent chromium was consistently encountered along the western Olin property boundary and the northern portion of the property in shallow overburden groundwater (potentially oxygenated) and in bedrock groundwater south and southwest of the containment area. In addition, hexavalent chromium was detected and exceeded its tap water RSL in approximately 10% of the samples collected. Given that these detections do not appear to be random, the Report shall be revised to include hexavalent chromium as a COC in groundwater.

Olin Response to Comment 73

Olin concludes that RI data collected to date do not support the inclusion of Cr VI as a COPC at the Site as discussed during the December 10, 2018 meeting. There are many analytical interferences for Cr VI, including cations. Where high concentrations of potential interferences exist, the potential for false positive detection increase. The distribution of Cr VI detection has no organized pattern and all the concentrations are the same magnitude throughout the aquifer where detected. There is no relationship with total Cr and in cases the Cr VI is greater than total Cr which is impossible. The geochemical conditions in the aquifer favor Cr III, not CR VI. There is insufficient evidence to include CR VI as a COC and COCs are not determined in the RI under CERCLA. EPA is evaluating the need for continued monitoring of Cr VI in future residential well sampling as these detections do not appear to be site related for the same reasons.

EPA response to Olin Response to Comment 73

Olin has agreed to include Cr VI in the upcoming comprehensive groundwater monitoring program. The QAPP has been reviewed and improvements to the Cr VI analytical method are being proposed. The results of this pending sampling shall be used to determine if inclusion of Cr VI as a COC is appropriate.

74. Page 4-38, Section 4.4.6. This section identifies hydrazine, Kempore and Opex as Specialty Compounds. However, the list of Specialty Compounds in the RI/FS Work Plan was more expansive and included dimethylformamide (DMF), phthalic anhydride, hydrazine, acetaldehyde, formaldehyde, nonylphenol, perchlorate, diphenylamine, tin, and the products Opex® and Kempore®. The Report shall be revised to discuss all of the Specialty Compounds identified in the RI/FS Work Plan.

Olin Response to Comment 74

The Report will discuss these compounds in the RI. The RI will present figures for hydrazine, Opex /Kempore and formaldehyde.

EPA response to Olin Response to Comment 74

Acknowledged

75. Page 5-1, Section 5.1. This paragraph is inaccurate and shall be deleted. DAPL is an ongoing source of contamination to the surrounding groundwater in the aquifer. There is no evidence of chemical equilibrium presented or discussed in this Report. Based on an evaluation of the trends in the analytical data conducted by EPA's contractor, the extent of contamination in the aquifers continues to expand indicating that equilibrium has not occurred. This expansion is governed by the typical processes associated with uncontrolled groundwater flow. In addition, there are also elevated levels of certain chemical compounds in the shallow and deeper overburden groundwater (i.e., NDMA is present at hundreds to thousands of ng/l in the overburden aquifer) which are also ongoing sources of contamination to the downgradient aquifer. This paragraph shall be revised to describe DAPL as an ongoing source of contamination to the rest of the aquifer. In addition, the Report shall also include a discussion of the other sources including the uncontained and migrating overburden groundwater containing elevated concentrations of COCs.

Olin Response to Comment 75

Alternative language is being discussed and affected paragraphs of the report will be modified accordingly.

EPA response to Olin Response to Comment 75

Acknowledged, pending review of alternative language.

76. Section 5.1, DAPL Pools. The text states that "DAPL concentrations have not increased in DAPL based monitoring data from 2003 – 2001." The Report shall define "DAPL concentration," and provide the monitoring data that support this statement.

Olin Response to Comment 76

The language will be revised for clarity.

EPA response to Olin Response to Comment 76

Acknowledged

77. Pages 5-1 to 5-5, Section 5.1. In addition to individual sources, the Report shall describe areas of groundwater impacts and indicate these areas on figures. The areas of groundwater impacts may

coincide with known source areas or may not, but these areas shall be described and potential sources identified.

Olin Response to Comment 77

Areas of groundwater impact are presented and discussed in Section 4 in text and figures. This information will again be summarized to relate potential sources and groundwater impacts in Section 5.

EPA response to Olin Response to Comment 77

Acknowledged. Section 4 figures shall include concentration contours to more effectively display groundwater impacts.

78. Page 5-4, Section 5.1. The Report states "It is believed the bedrock underlying the WBV [Western Bedrock Valley] was initially, and perhaps extensively impacted by DAPL, and now encompasses a broad area of diffuse groundwater with bedrock. This would be consistent with findings of bedrock borings installed around the perimeter of the DAPL pools (GW-202BR, GW-406BR, and MP-4). These wells contain diffuse groundwater, not DAPL, with few exceptions." Additional evidence and explanation is required regarding why only the diffuse groundwater and not DAPL has penetrated the bedrock fractures. The Report shall provide a more thorough explanation of this issue.

Olin Response to Comment 78

Olin will present its conceptual understanding of the area within the constraints of available data but will not postulate beyond supporting data.

EPA response to Olin Response to Comment 78

Acknowledged, however, if existing data proves to be incomplete or otherwise insufficient, EPA would consider this to be a data gap, and additional studies shall be proposed in the OU3 work plan.

79. Page 5-5, 3rd bullet. The Report states "The origin of NDMA is not known but precursor studies performed of DAPL and Diffuse Layer material did not indicate it forms in DAPL or diffuse chemical environments." The Report shall explain the source of NDMA even if the precursor studies could not replicate the field conditions. The Report shall include an analysis of NDMA concentration correlated with other compounds such as ammonia, sulfate, hydrazine, formaldehyde, or acetaldehyde; as well as correlations with depth, pH, and other characteristics. See also comment 61, above.

Olin Response to Comment 79

We cannot explain the source of NDMA because we do not know the source of NDMA at the Site as we've stated many times. The source of NDMA remains unknown (MACTEC, 2004). Any statements regarding the source of NDMA would be speculation. However, Olin will provide the requested data analysis. It should be noted that correlation studies were performed more than a decade ago and only ammonia and NDMA had a statistically significant correlation. The correlation with sulfate was not as good.

EPA response to Olin Response to Comment 79

The concentrations of NDMA detected at the Site are among the highest measured anywhere. Previous studies by Olin confirm that the precursors to NDMA were present in the manufacturing process and discharge effluent. EPA believes that it is important to gain a better understanding of the source of NDMA and this data gap should be addressed. Olin shall include a scope of work to address this data gap in the pending OU3 work plan.

80. Page 5-5, 3rd bullet. The first word of the 3rd sentence shall be NDMA, not DAPL.

Olin Response to Comment 80

The correction will be made.

EPA response to Olin Response to Comment 80

Acknowledged

81. Page 5-5, last bullet. The Report shall discuss the presence and extent of hexavalent chromium.

Olin Response to Comment 81

Please see response to Comment 73. The report will discuss hexavalent chromium.

EPA response to Olin Response to Comment 81

Acknowledged

82. Page 5-5. The paragraph titled "Domestic Gray Water" shall be deleted from the Report. Residential septic systems were not studied as potential sources of NDMA in the RI. Concentrations of NDMA in overburden groundwater significantly exceed the 8 to 80 ng/l of NDMA referenced in this study. Also, the Town of Wilmington is largely served by a municipal sewer system.

Olin Response to Comment 82

The reference is extremely relevant and should not be deleted. The potential for contribution of NDMA from greywater should be included to the list of potential sources in the CSM where residences are on septic systems. Sporadic detections of NDMA at distant residential wells are typically low, from just above the RL to between the RL and MDL.

EPA response to Olin Response to Comment 82

EPA continues to disagree with this statement. Detections of NDMA are in private wells which are screened several hundred feet into bedrock. Bedrock fractures remain the likely source of NDMA in these wells. The RI Report shall include EPA's position on this issue.

83. Page 5-6, Section 5.2.1. The 3rd paragraph states that the on-property DAPL pool is no longer considered to be a source of dissolved constituents to overburden groundwater. NDMA concentrations at the GW-202 cluster, downgradient of the slurry wall, remain elevated from shallow overburden to deep bedrock. This suggests that either the slurry wall is not sufficiently protective or that significant residual contamination remains in the subsurface south of the containment cell. It is not clear that the ongoing contamination is entirely from the Main Street DAPL plume. Therefore, the on-property DAPL pool shall be discussed specifically as an ongoing source to the downgradient aquifers.

Olin Response to Comment 83

The source of impacted groundwater to the referenced wells is the upgradient off-Property DAPL pool not the Containment Area. The groundwater flux through the area precludes the Containment Area as the source of impacts. Further the Containment Area cannot be the source of impacts to other nearby wells such as PZ 18RR and GW-55S/D due to groundwater flow directions. Without substantive data to fill data gaps Olin cannot at this point concur with USEPA's CSM.

EPA response to Olin Response to Comment 83

Olin has not provided sufficient data to support the conclusion that the source of elevated concentrations in wells GW-202, PZ-18RR and GW-55 is the off-Property DAPL pool. The revised report shall include EPA's position on this issue.

84. Page 5-7, Section 5.2.2, 1st and 2nd paragraph. Figure 4.4.1-1a clearly shows a plume of NDMA in shallow groundwater beneath the Maple Meadow Brook wetland, extending from GW-82S to MP-5 to GW-65S. These locations also have relatively high chloride concentrations and sodium concentrations relative to other monitoring wells in the MMBW. Kempore and hydrazine have been detected in MMBW surface water. Therefore, the MMBW may be potentially impacted by contaminated shallow groundwater. The text shall be revised accordingly.

Olin Response to Comment 84

Fate and transport considerations (namely dilution and solubility) prohibit the conclusion put forth by USEPA. Modifications cannot be made to the text as requested without substantive further discussion and most probably additional sampling and analysis (noting there is no longer a source for a laboratory analytical standard for Kempore).

EPA response to Olin Response to Comment 84

The following sentence in Section 5.2.2 states, "Shallow groundwater underlying surface water in MMB and Sawmill Brook does not have elevated concentrations of site-related contaminants, and therefore surface water quality has not been impacted in these surface water systems." There is elevated NDMA in the shallow groundwater screens within the MMB aquifer. Therefore, this sentence shall be corrected. In addition, Olin shall clarify that although NDMA has not been detected in surface water samples from MMB collected to date, Kempore and Hydrazine have been detected. Further monitoring shall be conducted to gain a better understanding of the fate and transport of the compounds in this area.

85. Page 5-7, Section 5.2.2, 5th paragraph. The numerical model is presented in Appendix H, not Appendix K as indicated. This reference shall be corrected.

Olin Response to Comment 85

The reference will be corrected.

EPA response to Olin Response to Comment 85

Acknowledged. Although the model will not be referenced in the revised RI report per Olin's response to Comment 86.

86. Page 5-7 to 5-8, Section 5.2.2. The conclusions that the "removal of DAPL as remediation strategy will not contribute significantly to groundwater restoration for fractured bedrock," and "Since the same matrix diffusion effects apply to bedrock located under the MMB aquifer, restoration of that aquifer is also improbable or impracticable due to the long-time frame back diffusion would occur from the affected rock matrix," are not supported by the available data set and shall be deleted. The data documents a significant volume of DAPL in the deep overburden aquifer and in shallow fractures. The data further documents that active chemical diffusion from the DAPL to the overlying and underlying groundwater continues, resulting in several diffuse groundwater plumes, and a broad overlying groundwater plume. The conclusions in the numerical model, and the model itself, are outside the scope of the remedial investigation, and shall be removed from discussion here. Such models may be discussed and considered in the feasibility study during the development and evaluation of remedial alternatives. In addition, any model utilized, including its purpose and input parameters shall be reviewed and approved by EPA before its use. References to this model throughout the Report shall be deleted.

Olin Response to Comment 86

Olin shall pursue a TI Evaluation as described previously at a later date. The model provides a valuable function. Olin will not discuss the findings of the model in the revised OU3 RI Report, but will hold further evaluation in abeyance until such time as a TI evaluation becomes more appropriate.

EPA response to Olin Response to Comment 86

Acknowledged

87. Pages 5-7 to 5-8, Section 5.2.2. The Report contends that the overburden and bedrock aquifers are connected and that pumping the overburden aquifer would depress the bedrock aquifer, and therefore pull contaminants from the bedrock to the overburden.

a. Given the thickness and apparent high conductivity of the overburden aquifer in the vicinity of the MMBW, and the lack of definitive connection between the bedrock and overburden in this area, the Report's conclusion is not supported. The Report has not provided a rigorous evaluation of pumping vs. non-pumping conditions on the overburden and bedrock aquifer. A pumping test or series of pumping tests would help to evaluate the extent to which overburden pumping would pull in

bedrock groundwater. In lieu of this data, the Report shall include a comparison of hydraulic data collected before and after pumping cessation.

b. Olin provides additional support for the potential connection between bedrock and overburden groundwater during pumping in Section 1.4.2 of the Draft OU3 FS Report (AMEC, 2018), describing trends in GW-103D. An evaluation of the trends for the parameters described in the Draft OU3 FS Report in the wells closest to the Chestnut Street pumping wells (GW-103 cluster and GW-63 cluster), as well as the wells closest to the next-closest pumping wells (GW-64 cluster and GW-86 cluster), did not demonstrate a consistent trend for these parameters. The Report shall include trend charts and a full evaluation of these trends to evaluate the potential for overburden-bedrock connection.

Olin Response to Comment 87

Data will be provided as requested.

EPA response to Olin Response to Comment 87

Acknowledged

88. Page 5-8, Section 5.2.3. The next to last bullet is speculative and not supported by the available data set. There is no data to demonstrate transfer of NDMA into the bedrock matrix. This bullet shall be deleted.

Olin Response to Comment 88

The bullet will not be deleted as it is not speculative. Theory of matrix diffusion is adequately developed in literature, in EPA sponsored models and has been demonstrated for similar compounds with similar diffusion coefficients at other sites, including in Region 1. The modeling data presented is representative of the process. As discussed Olin shall pursue this evaluation as part of a TIE.

EPA response to Olin Response to Comment 88

EPA has reviewed the model and disagrees with several of the key inputs, and therefore questions the validity of the model output. Olin has agreed to prepare the IAFS and has expressed an intent to complete a technical impracticability demonstration. The objective of the Interim Action Feasibility Study is to develop source control alternatives. Therefore, Olin shall refrain from making statements regarding the efficacy of aquifer restoration at this time. This bullet shall be deleted.

89. Page 5-8, Section 5.2.3. Additional routes of migration include the following, which shall be added to the text:

    a. Shallow groundwater migration from the central portion of the MMBW to surface water.

    b. Interception of contamination by private well pumping, causing sporadic NDMA detections.

Olin Response to Comment 89

Surface water in MMB is not impacted therefore bullet "a" cannot be included. Bullet "b" can be included with exception depending on location.

EPA response to Olin Response to Comment 89

Acknowledged

90. Page 5-9, Section 5.3. The Report shall include leaching of contaminants from soil as a potential transport mechanism in groundwater.

Olin Response to Comment 90

A leaching evaluation will be provided as requested. Leaching from soil has a limited scope for transport at the site and may be appropriate for limited areas such as where hydrazine is present above the water table in the vicinity of Plants C and D. Note with respect to hydrazine, the higher soil concentrations appear to be below the water table and therefore leaching is not the transport mechanism; rather it is partitioning and aqueous equilibrium.

EPA response to Olin Response to Comment 90

Acknowledged

91. Page 6-1 BHHRA Summary. The Report shall be revised to include the private potable wells on Cook Avenue in the analysis.

Olin Response to Comment 91

The BHHRA has been revised since submission of the RI to accommodate USEPA requests. The final RI will reflect the most recent BHHRA.

EPA response to Olin Response to Comment 91

Acknowledged

92. Page 7-2. The Report states "The hydraulic conductivity of the slurry wall is less than 1E-8 cm/sec. Based on extensive evaluation, there are no hydraulic indications that the function of the slurry wall is compromised in any way." The HPIT failed to determine anything about the hydraulic conductivity of the slurry wall and raised suspicion that the water traveled through bedrock fractures in and around the containment area. This statement shall be deleted from the Report. The Report also states: "The on-Property DAPL pool is not considered a source of current impacts to South Ditch." This statement shall be revised to clarify that the on-property DAPL pool is a contributing source of impacts to the south ditch and to the overburden and bedrock aquifers.

Olin Response to Comment 92

These statements will not be revised. The hydraulic conductivity of the slurry wall was documented by extensive QA/QC sampling and flexible wall permeameter testing. EPA requests Olin revise its conclusion based on an admitted suspicion (see above) and not any factual data. Olin does not believe the on-Property DAPL pool is an ongoing source to overburden groundwater and South Ditch and USEPA continues to make this assertion without quantifiable analysis or data. Further discussion regarding potential data gaps associated with the Containment Area are on-going.

EPA response to Olin Response to Comment 92

EPA's believes that there are multiple lines of evidence which support the conclusion that the slurry wall alone may not be a sufficient containment system. EPA believes there is leakage through the bedrock and/or the slurry wall and top of rock interface. This evidence includes construction logs for the slurry wall, area borings, water level monitoring, the HPIT test and analytical data. EPA has sent a separate memorandum to elaborate on this conclusion. Olin's assertion that there is no leakage of DAPL and highly contaminated groundwater from within the slurry wall containment system is baseless. Olin shall modify the report accordingly.

93. Page 7-2. The Report states "Restoration of fractured bedrock is also believed to be technically impracticable due to the long-time frame NDMA has been in contact with bedrock at high concentrations and the fate and transport characteristics of NDMA as described and corroborated by the model." Additional information is needed to support this conclusion, and it shall be removed from the Report.

Olin Response to Comment 93

The statement will not be removed from the Report, though the context will be modified. Olin will add its intention to pursue a TI evaluation.

EPA response to Olin Response to Comment 93

Same response as Comment 88. EPA has reviewed the model and disagrees with several of the key inputs, and therefore questions the validity of the model output. Olin has agreed to prepare the IAFS and has expressed an intent to complete a technical impracticability demonstration. The objective of the Interim Action Feasibility Study is to develop source control alternatives. Therefore, Olin shall refrain from making statements regarding the efficacy of aquifer restoration at this time.

94. Page 7-3. The Report states "There is no evidence to indicate NDMA is currently forming in DAPL or diffuse groundwater or has ever done so." Just because the formation of NDMA could not be replicated in a lab setting, does not mean that it did not form in the aquifer, and/or during the manufacturing process. The Report shall provide further explanation, with supporting data, regarding the source of NDMA.

Olin Response to Comment 94

The source of NDMA continues to be unknown (MACTEC, 2004). Any conclusion or statement otherwise relative to the source of NDMA would be purely speculative. There is not further explanation of data to draw any different conclusion.

EPA response to Olin Response to Comment 94

Previous studies by Olin confirm that the precursors to NDMA were present in the manufacturing process and discharge effluent. EPA believes that further work should be conducted to better understand the source of NDMA is. Olin shall include a scope of work to address this data gap in the pending data gap work plan.

95. Appendix A shall include all available boring logs and well construction logs, not just the logs created during the RI field investigations. The RI Report shall be a complete record of the Site and the reader should not be required to locate this information in other reports. Appendix A would therefore be referenced instead of the "previous reports" mentioned in Section 2.1.2.10 and in other sections, as needed.

Olin Response to Comment 95

USEPA has on at least two occasions been provided a full compendium of all available historical logs as far back as in 2008. The revised RI will merge historical and recent logs into one compendium.

EPA response to Olin Response to Comment 95

Acknowledged.

96. Appendix D shall include all available borehole geophysics results available, not just those from the RI field investigations.

Olin Response to Comment 96

The appendix did include all available logs. Some of the available logs are early generation logs and are not available in the current formats. Some logs are contained in early reports authors such as those developed by Geomega. Many of the early logs from this era were not digital. USEPA should not expect that older geophysical data is necessarily in an easily retrievable electronic format.

EPA response to Olin Response to Comment 96

The remedial investigation report is expected to be a stand-alone document. Olin shall provide copies of all available logs, and not just those that are in an easily retrievable electronic format. Older logs shall be scanned and provided in the revised report.

REFERENCES

MACTEC, 2004 Phase II Comprehensive Site Assessment (CSA) Submittal, Initial Testing of Proposed Analytical Test Method for NDMA Precursors, 51 Eames Street Site, Wilmington, MA RTN 3-0471

Teng Zang and William A. Mitch, 2015. Contribution of N-Nitrosamines and their Precursors to Domestic Sewage by Greywaters and Blackwaters. Environ. Sci Technol. 2015, 49 pages, 13158-13167.

ATTACHMENTS

Cross-Sections C-C′

APPENDIX 2

EPA Comments on Draft Remedial Investigation Report, Operable Unit 3 (March 30, 2018) as supplemented by a memorandum entitled, *Containment Area Bedrock Boring Results, Olin Chemical Superfund Site (OCSS) in Wilmington MA (Site), May 10, 2018*
Olin Chemical Superfund Site, Wilmington, Massachusetts

A Memorandum entitled*, Containment Area Bedrock Boring Results, Olin Chemical Superfund Site (OCSS) in Wilmington MA (Site), May 10, 2018* was prepared by Wood and subsequently transmitted via cover letter to EPA on May 10, 2018.

This memorandum summarizes the installation of two bedrock borings in the containment area (1 within, 1 just outside) to evaluate the integrity of bedrock in this area. The purpose of the work, stated in the *Summary of Work Performed*, is, "to collect additional information and to verify the nature of the bedrock underlying the Containment Area and the associated DAPL pool at the Site," yet only one of the two borings drilled for the effort were advanced in the area directly beneath the containment area itself. As such, firm sweeping conclusions regarding the nature of the bedrock in this area are difficult to support.

Based on EPA's evaluation of all data available for the containment area, EPA is unable to concur with Olin's conclusion (from the executive summary) that, "*the bedrock underlying the Containment Area is highly competent and no additional investigation is warranted to verify the competency of the bedrock in the vicinity.*" This conclusion, which EPA has called into question previously due to lack of supporting information, remains an unproven opinion. As demonstrated in the comments below, the investigation failed to characterize key areas of the bedrock beneath this area, including areas where there is a high probability of fracturing. Moreover, EPA interpretations of the currently available data suggest that fracture connectivity between the sub-containment area bedrock and known and/or undiscovered fractures likely exist.

GENERAL COMMENTS

1. The study and its conclusions are rejected. The reasons are numerous and are discussed more fully in the comments, below. The design was unilaterally developed by Olin and its consultant, Wood, in the absence of regulatory input and/or in conflict with previously supplied comments and suggestions. The study and its conclusions are critically flawed. Additional technical input would have resulted in a more robust design with meaningful conclusions. For the technical reasons provided in the analyses discussed below, EPA rejects the conclusions of this effort. The Draft OU3 RI Report ("RI Report") shall be revised to include the analysis provided by EPA in comments below and conclude that the bedrock beneath the containment area is not competent and that fracture connectivity between the sub-containment area bedrock and known and/or undiscovered fractures likely exists. Furthermore, while the comments below provide recommendations for additional targeted work, this work is only needed

to refine EPA's conceptual site model ("CSM") by providing better information on the locations and extent of fractures, not to demonstrate competency of the bedrock. EPA believes that this information, as well as other information contained in the RI Report and further discussed in comments on the RI Report, strongly supports the need for the development of a Feasibility Study with robust source control alternatives for this area.

Olin Response to General Comment 1

Data collected to date show that the bedrock in the vicinity of the containment area is competent (e.g., GW-202BR; BR-1; OC-BB-1-2018; and OC-BB-2-2018). In addition to data collected during wells/borings installation, information collected during abandonment of OC-BB-2-2018, which was installed within the Containment Area, confirmed lack of water-bearing fractures at that location. The methodology used to complete abandonment at BB-2 was developed in concert with the USEPA technical case team and approved by USEPA prior to implementation. Additionally, USEPA's Hydrogeologist and representatives from USEPA's third-party contractor (Nobis) were present to verify that the abandonment was completed in accordance with the approved methodology. The data collected to date, continue to indicate that the bedrock beneath the containment area (certainly at the boring locations referenced herein) is competent.

USEPA has raised the concerns of potential fracturing directly beneath the DAPL pool and the integrity of the slurry containment wall itself. Olin has proposed to collect additional relevant data to refine the CSM in the Containment Area. Olin and USEPA intend to meet during January 2019, at Olin's insistence, to further discuss these data gaps in an attempt to reach concurrence on the data gaps as well as methodology that will be used to close them. Further, as discussed during a meeting on December 10, 2018, Olin will prepare an interim action feasibility study (IAFS) while filling data gaps.

EPA Response to Olin Response to GC1

The original comment stands. Olin's response applies to borings which are on the periphery or are outside of CA (including OC-BB-2-2018) and therefore have little to no relevance to geologic conditions beneath the central and interior portions of the CA. Olin has proposed to collect additional relevant data to refine the CSM in the Containment Area. EPA agrees that targeted work is needed. However, it must be emphasized that such work is most acutely needed to enhance the CSM by providing specific information on the locations, depths, extent and hydraulic significance of fractures *beneath the containment area itself*, not simply to further assess "competency" of the bedrock in peripheral areas. A robust CSM will require additional systematic collection of information in all these areas. We look forward to working with the Olin Case team to develop a scope-of-work to address these data gaps. (Please see also EPA's response to Olin's January 18, 2019 memorandum entitled, *Abandonment of Containment Area Boring OC-BB-2-2018,* to be provided separately).

2. EPA's analysis suggests that there are at least 3 primary fracture orientations present at the site-scale which have strong potential to influence contaminant distribution and migration within the bedrock beneath and peripheral to the containment area. These include the following:

    - Sub-horizontal to shallowly-dipping "sheeting" fractures;
    - Northeast-striking fractures - Moderate to Steeply dipping (to NW); and

- Northwest-striking fractures - Steeply dipping to sub-vertical.

The characteristics, relevance, and importance of each of these fracture sets are discussed in separate comments below, emphasizing the issues of bedrock nature, composition and competency relative to the robustness of the interpreted "containment" properties of the bedrock immediately underlying the containment area. It should be noted that each of these three major classes of fracture types discussed above are represented in each of the borings OC-BB-1-2108 and OC-BB-2-2108. Summary tables for each of these boreholes are included below as specific comments.

Sub-horizontal to shallowly-dipping sheeting fractures; These types of fractures are common in the shallow bedrock zone in glaciated terrains. While potentially present at greater depths, shallowly-dipping fractures are commonly observed in the upper portions of the bedrock in the glaciated northeast U.S. In New England, these are most commonly observed in shallow regions to a depth of 100 feet or less into bedrock. Nobis' comment letter of May 21, 2018 identified this issue and noted numerous observations on the drilling logs for OC-BB-1-2018 and OC-BB-2-2018 consistent with this style of fracturing. This analysis confirms the potential importance of these shallow sub-horizontal fractures relative to contaminant transport within and potentially beyond the containment area. Since the containment wall is only installed to the top of the bedrock surface, it appears possible (if not likely) that lateral transport pathways utilizing shallow sub-horizontal fractures in the upper part of the bedrock may exist, and if so, are not impeded by the containment wall. Given the potential importance and likely presence of such features, the investigation should have targeted them. Rather, as noted in Nobis' comments, the investigation essentially avoided them by casing off the upper portion of bedrock with the notable exception of OC-BB-2-2018, which inadvertently exposed a large-aperture fracture with a shallow dip at 32.3 ft bgs. This fracture appears to be significant hydraulically, and is an excellent example of the larger class of sub-horizontal/shallowly-dipping sheeting fractures which likely exist over large areas of the containment area's subsurface. Similar features were noted on the drilling log for OC-BB-1-2018 but were cased-off, (as is appropriate), by the grouted steel casing. While OC-BB-1-2018 appears to be appropriately constructed to assess deeper rock, it is not suitable to assess shallow fracturing due to the grouted steel casing which seals off such features. OC-BB-2-2018 is suitable for neither as its failed casing installation essential creates potential for short-circuits which confound assessment and differentiation between shallow and deeper zones. After OC-BB-2-2018 is demonstrated to be plugged and abandoned in a verifiable manner, if future work is conducted, this work should be targeted towards deeper bedrock within the central portion of the containment area. In addition, future bedrock characterization efforts here and elsewhere on the Site need to take deliberate steps to characterize the uppermost shallow bedrock interval, utilizing methods which can identify and assess the presence and significance of these shallow sheeting fractures. Finally, in areas such as the central portions of the containment area or any other area where significant source material exists, double- or triple-casing installations or other specialized drilling approaches will need to be considered.

Northeast-striking fractures; The northeast-to-southwest strike is clearly the predominant orientation of the bedrock compositional layering (foliation) and associated fracturing. A large percentage of the hydraulically-significant fractures identified in boreholes seem to follow the foliation strike and dip to a significant degree. Dips of foliation layering as well as dips of foliation- parallel fractures appear to be relatively consistent to the northwest at steep to moderate angles. Because of these relatively steep dips, fracture information collected at one location is not necessarily relevant to other areas at

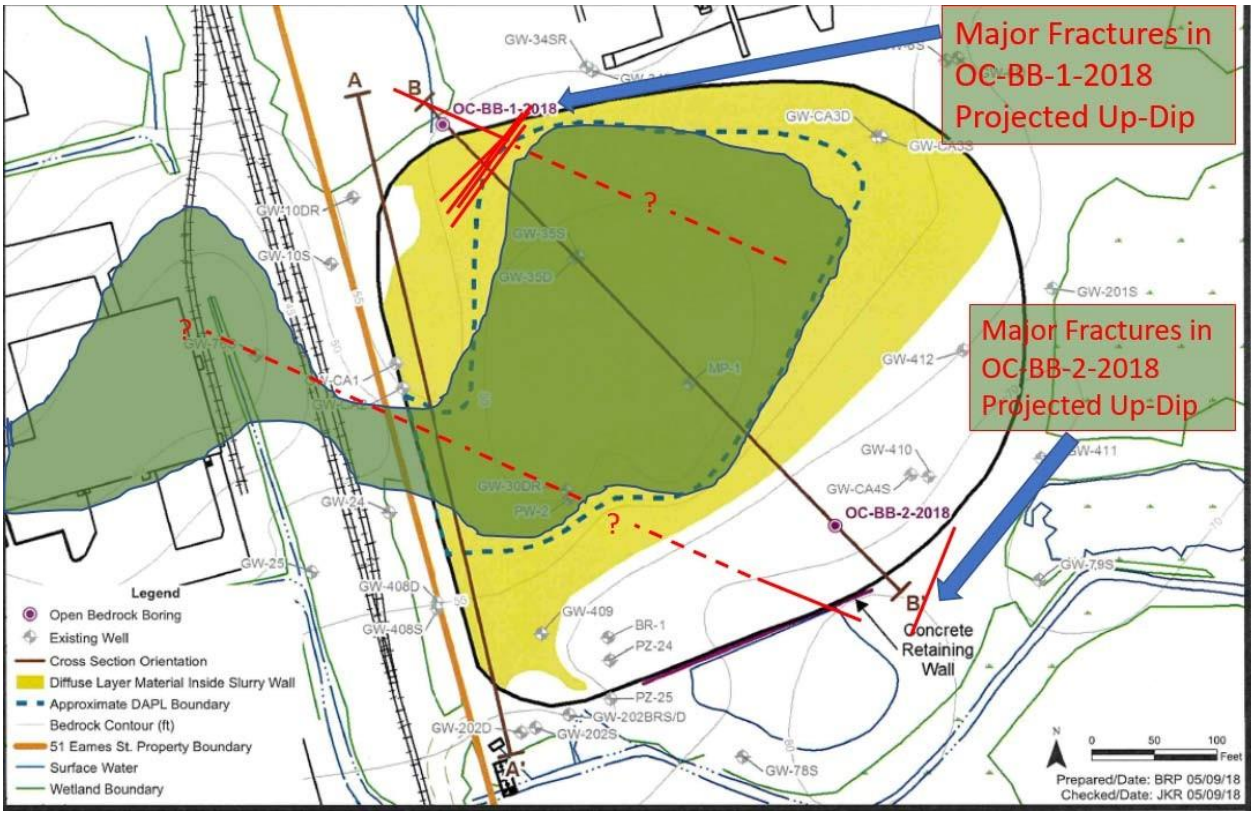
relatively small distances normal to strike. As such, the current investigations, both at the containment area scale as well as the larger Site scale, have not fully assessed the stratigraphic variability which likely exists at the Site. Variations in rock composition may result in differences in fracture style and density as well as variations in primary and secondary porosity. It is not yet clear that all the primary fracture pathways which exploit the NE-SW fabric have yet been identified at the Site. This problem is most acute beneath the containment area. Due to study design's failure to recognize the importance of stratigraphic dip angle, the investigation resulted in few new insights with regards to "competency" of bedrock beneath the bulk of the containment area. The detailed analysis EPA completed for this study suggests that several hundred feet of stratigraphic section beneath the containment area remain uncharacterized. OC-BB-1-2018 and OC-BB-2-2018 only assessed the margins of the containment area and Olin/Wood's efforts to "verify the nature of the bedrock underlying the Containment Area" remain unfulfilled. Potential impacts due to northeast striking fractures beneath the containment area remain unassessed. The following comments provide additional detail as well as the technical basis for EPA's conclusions in this regard. Further assessments will be needed. Future investigations in the containment area and elsewhere at the site need to more carefully consider the steep to moderate dips of the NE-SW striking features.

Northwest-striking fractures - Steeply dipping; Steeply-dipping fractures of NW-SE strike are common in the northeast U.S. and are commonly of significant importance hydraulically. The steep dip angles, near vertical in many cases, however, make these difficult to intersect with randomly located bedrock boreholes. These difficulties notwithstanding, the available Site data suggests that such features are present across the site, and are therefore of potential importance and deserving of future focused efforts. The limited containment area study corroborates this. Both OC-BB-1-2018 and OC-BB-2-2018 intersected steeply dipping NW-SE striking fractures of potential hydraulic significance. It is noted that in each of these boreholes, the steeply dipping NW-SE striking fractures can be projected upward into the containment area. While the strike length of these features is not known, specific features of this orientation intersected by OC-BB-1-2018 and OC-BB-2-2018 have at least the potential to "daylight" beneath the containment area, and may thus provide a pathway into bedrock. This potential pathway needs to be further assessed. As recommended previously, favorably oriented surface geophysical surveys shall be employed to identify specific drilling targets for future phases of work. This is especially important for these types of steeply-dipping fractures. For example, lines oriented SW to NE are recommended along the northern and southern margins of the containment area to guide future drilling efforts targeted to additional NW-striking fractures which may underlie the containment area.

Sufficiency of the Characterization of Bedrock Integrity within and beneath the Containment Area; EPA is unable to concur with the report's central conclusion, i.e., that the "bedrock underlying the Containment Area is highly competent and no additional investigation is warranted to verify the competency of the bedrock in the vicinity." Rather, EPA believes the opposite conclusion is the simplest and best explanation for the current data. In summary, EPA's emerging conceptual model for the containment area includes the following elements, and the RI Report shall be revised to include this conceptual site model:

- The containment area is in the core/hinge of a tight fold in the metamorphic rocks.

- Geologically, such an area is more likely to have a higher fracture density than the limbs/flanks of such a fold.
- Cross sections A-A' and B-B' indicate a depression of lower elevation on the bedrock surface in the central portion of the containment area.
- This groove-like depression is oriented NE-SW, generally consistent with the regional strike and plunge of the fold axis.
- Such depressions on the bedrock surface are commonly associated with compositional variation in the bedrock (e.g., softer rock) and/or more fracturing, which both may have contributed to a greater amount of differential glacial scouring relative to adjacent areas (i.e., during the 'recent' Pleistocene glacial period).
- The extreme vertical exaggeration employed on Wood's hydrogeologic cross sections lead to misleading conclusions due to the distorted angular relationships and should not be used except with extreme caution for interpreting conditions beneath the containment area;
- EPA has prepared true-scale geologic cross sections with no vertical exaggeration which indicate that OC-BB-1-2018 and OC-BB-2-2018 have only characterized the margins of the containment area.
- Examination of the true-scale cross section with measured dip angles reveals the limits and ineffectiveness of the current investigation.
- Most of the rock mass beneath the containment area is essentially uncharacterized, amounting to roughly 350 of uncharacterized stratigraphic section.
- This data gap underlies the central portion of the containment area and the DAPL area, which as stated above is likely more heavily fractured than the peripheral areas.
- Even though they are located on the periphery of the containment area, OC-BB-1-2018 and OC-BB-2-2018 both intersected fractures which may project upward into the bedrock beneath the containment area.
- All three primary classes of fractures discussed above for the Site in general are represented in the data collected for OC-BB-1-2018 and OC-BB-2-2018, and depending on the strike lengths of specific features (which are not known presently), fractures penetrated by these borings have the possibility of intersecting/connecting with the interior of the containment area, including the DAPL area, with reasonable assumptions for strike and dip continuity.



Olin Response to General Comment 2

Olin is willing to conduct additional evaluation as needed. EPA's CSM over simplifies that "since the containment area is in the core/hinge of a tight fold in the metamorphic rocks, it is more likely to have a higher fracture density than the limbs/flanks of such a fold". It appears that EPA is giving more consideration to regional geology but not considering Site level data that have been collected for over 20 years. Although we have to consider regional bedrock structures, we also have to equally consider site level data to evaluate site-specific features. Without any specific data, it is unclear how EPA can come to sweeping conclusions. EPA is critiquing Olin that there isn't enough data to make sweeping conclusions, but EPA is doing the same with the same "limited" data.

With respect to containment area borings, OC-BB-1-2018 and OC-BB-2-2018, EPA speculates that "fractures penetrated by these borings have the possibility of intersecting/connecting with the interior of the containment area". Currently no data exists to definitively support EPA's CSM. Further, as requested by EPA, Olin abandoned OC-BB-2-2018 borehole in December 2018. The borehole was abandoned as per the EPA approved procedures. The procedures followed during the abandonment concluded that there is no horizontal fracture, as speculated by EPA, at ~32 ft bgs at OC-BB-2-2018. EPA's Hydrogeologist and their independent consultant oversaw the abandonment and agreed with the implemented abandonment procedures in the field.

In order to install a bedrock well the casing has to be seated in competent bedrock. Review of all borings in the Containment Area indicate the till at the bottom contains boulders and that depending on drilling observation such materials could be interpreted as weathered bedrock when they are not. Borehole logs

from BR-1, GW-202BR, OC-BB-2-2018, BB-1-2018 indicate casings were installed at the top 1 to 3 feet of competent rock where encountered. When sonic drilling of GW-202BR was attempted, three drill rods broke within the first 13 feet of bedrock and the borehole had to be completed by air hammer methods. For comparison, the other OU3 deep bedrock wells were easily drilled by sonic methods to depths up to several hundred feet. Based on drilling methods alone, the bedrock at the Containment Area is immensely harder and more competent than bedrock encountered anywhere else at the Site. Hence, USEPA comment that Olin avoided characterizing shallow bedrock in the containment area is incorrect.

USEPA asserts that the borehole geophysical logs of both OC-BB-1 and OC-BB-2 indicate the presence of numerous horizontal and sub horizontal "sheeting" fractures. Specifically USEPA notes *the potential importance of these shallow sub-horizontal fractures relative to contaminant transport within and potentially beyond the containment area. Since the containment wall is only installed to the top of the bedrock surface, it appears possible (if not likely) that lateral transport pathways utilizing shallow sub-horizontal fractures in the upper part of the bedrock may exist, and if so, are not impeded by the containment wall.* USEPA errs in its interpretation of caliper logs that abundant hydraulically active sub horizontal fractures are present. The Acoustic Tele Viewer (ATV) and digital logs show all identifiable fractures whether they are potentially water bearing (open) or not (healed). The intensity of the ATV travel time and amplitude logs can be excellent indicators of a potential water bearing feature since they measure loss of acoustic energy into such voids. The caliper logs measures variation in the borehole diameter and hence not all caliper deviations are fractures. A caliper variation will occur every time a slightly larger chip of rock is dislodged, in this case, by the violent pounding action of the air percussion hammer. These will result in small apparent apertures in the several mm range that are reported by the geophysicist. The presence of such measurements does not mean that these caliper variations represent water bearing fractures. It is industry practice to look for other diagnostic and confirming information from other logs where caliper deviations and ATV anomalies occur. These include inflections in spontaneous potential, single point resistance, followed by temperature and fluid conductivity logs. This information combined with HPFM data in ambient and pumping conditions then provides information to the geophysicist to interpret whether a fracture feature is potentially water bearing or not.

Further, USEPA's summary of northwesterly and northeasterly fracturing firsts points out that such fractures are common in the northeastern US and commonly present Site-wide. While this is true it is not a basis to project or conclude that such fractures are also prevalent and well connected beneath the Containment Area, when the siliceous quartzite lithology encountered on both sides of the Containment Area is clearly distinct from other lithologies across the Site (as determined by boreholes and regional published bedrock mapping). This was highlighted to USEPA in meetings where plots of cumulative aperture of hydraulically active fractures versus borehole depth were presented and it was clearly shown that fracturing of hydraulic significance in GW-202BR at the Containment Area was anomalously absent compared to other site-wide borings (Figure 1 shows the previously provided cumulative aperture plot). OC-BB-1 and OC-BB-2 reinforce this difference.

However, as discussed during the meetings on October 25 and December 10, Olin is not adverse to additional characterization and is willing to collect data that is relevant and meaningful. Further, Olin is willing to work with the EPA to develop an appropriate and functional work plan that will help refine the CSM in the vicinity of Containment Area. Olin will append the IAFS as necessary if data gaps investigation results indicate the need for interim action at the Containment Area.

EPA Response to Olin Response to GC2

The original comment stands. Olin's rebuttals are unpersuasive as they rely on a one-sided view of the limited information. For example, in the first paragraph of the response, Olin states,

> *EPA's CSM over simplifies that "since the containment area is in the core/hinge of a tight fold in the metamorphic rocks, it is more likely to have a higher fracture density than the limbs/flanks of such a fold". It appears that EPA is giving more consideration to regional geology but not considering Site level data that have been collected for over 20 years. Although we have to consider regional bedrock structures, we also have to equally consider site level data to evaluate site-specific features. Without any specific data, it is unclear how EPA can come to sweeping conclusions. EPA is critiquing Olin that there isn't enough data to make sweeping conclusions, but EPA is doing the same with the same "limited" data.*

It should be noted that the fold structure EPA referred to in its comments is contained in published information. EPA consulted the bedrock geologic map entitled, *Bedrock geologic map of the Wilmington quadrangle, Massachusetts, Castle, R.O, Hepburn, J.C., and Kopera, J.P., v. 1.0, Massachusetts Geologic Survey (4th)*.

The fold in question is mapped *at the scale of the Containment Area*, has similar dimensions as the CA, and directly overlaps with the containment area boundaries. It is therefore, contrary to Olin's assertions, inappropriate and geologically incorrect to dismiss such a feature as being "regional" and therefore irrelevant to the CSM in the CA at the scale of the CA. Conversely, EPA's analysis offered a CSM which addressed information at a variety of scales, suggesting a slightly different configuration for the fold structure based on site-specific information. There is no basis to ignore the feature altogether, but Olin's CSM dismisses the feature and makes "sweeping conclusions" regarding the general lack of fracturing in the greater CA based on location-specific information from only a couple of locations in the southern periphery of the CA. In other words, it is Olin who is "over simplifying" the existing information to prop up its CSM. The geologists at the Massachusetts Geological Survey responsible for the mapping in question have an extensive body of published work.

In its rebuttals Olin continues to inappropriately conflate unrelated issues in attempts to support the lack of bedrock information in the central portion of the CA. For example, in the second paragraph of the response, to refute EPA's hypothesis that fractures identified in borings on the periphery of the CA may project into the subface beneath the CA, Olin notes that "currently no data exists to definitively support EPA's CSM". This assertion merely further supports EPA's central point, i.e., *additional bedrock data is needed in the interior portions of the CA*. Olin then goes on to describe observations during closure of OC-BB-2-2018 as supporting their CSM. Much is stated here and elsewhere regarding the lack of supporting information from that effort which could corroborate the presence of a large-aperture fracture at ~ 32 ft bgs at that location (at the periphery of the CA; Please see also EPA's response to Olin's January 18, 2019 memorandum entitled, *Abandonment of Containment Area Boring OC-BB-2-2018,* provided separately). Again, this observation, while relevant, and contributing to the overall CSM, does nothing to augment the near-absence of relevant bedrock information beneath the central interior portions of the CA. Again, Olin's rebuttal merely enhances EPA's central thesis.

In the third paragraph of the response, Olin cites the difficult drilling conditions encountered while drilling BR-1, GW-202BR, OC-BB-2-2018, BB-1-2018. Olin states, "*When sonic drilling of GW-202BR was attempted, three drill rods broke within the first 13 feet of bedrock and the borehole had to be completed by*

air hammer methods." EPA notes that sonic is not considered to be a superior method in comparison to air rotary drilling in hard rock bedrock settings. EPA therefore calls into question Olin's selection of sonic focused to bedrock drilling objectives. The fact that the method was successful in other areas of the site may say more about the relative softness and/or density of fracturing in the rock in those areas rather than the hardness of the rock in the CA. In any case, Olin concludes this rebuttal by stating, "*Based on drilling methods alone, the bedrock at the Containment Area is immensely harder and more competent than bedrock encountered anywhere else at the Site. Hence, USEPA comment that Olin avoided characterizing shallow bedrock in the containment area is incorrect*." This is nonsensical and again misses the point. The fact that Olin had difficulty drilling on the *margins* of the CA says nothing about the character of the bedrock *beneath the central/interior portions of the CA*.

In the fourth paragraph of the response, Olin attempts to refute EPA's observations of multiple gently-dipping fractures identified in logs produced for OC-BB-1-2018 and OC-BB-2-2018 by essentially stating that not all fractures noted on drilling logs or borehole geophysical logs are "water-bearing". While this generic statement is generally true, the response takes pain to avoid specific features. EPA's analysis offered in 2018 presented tables which itemized several shallowly-dipping fractures in the upper intervals (<100 feet into rock) in both OC-BB-1-2018 (at least 14 potential features) and OC-BB-2-2018 (at least 4 potential features). While the relative and absolute hydraulic significance of these features is not yet known, the coarseness (lack of vertical resolution) and technical limitations of the HPFM data collected from these limited depths and locations results in considerable persistent uncertainty in this regard. Until additional information is collected to specifically assess the potential for hydraulically significant sheeting fractures in the upper bedrock, EPA's concerns regarding this potential migration pathway relative to the CA cannot be dismissed.

Olin's point in the fifth paragraph of the response again avoids the central issues. Olin states that fracturing of hydraulic significance in GW-202BR at the Containment Area was anomalously absent compared to other site-wide borings," and similar conditions at "OC-BB-1 and OC-BB-2 reinforce this difference." Olin speculates that the "siliceous quartzite lithology encountered on both sides of the Containment Area" is responsible for this apparent difference (as compared to other sub-areas of the vast site). Once again, Olin attempts unconvincingly to conflate siliceous rock types with a lack of hydraulically significant fracturing. At this point, the assertion amounts to little more than speculation given the lack of geographic diversity in the few data points assessed. Even if this inferred relationship were true, the response again attempts to conflate borings from the *northern and southern periphery* of the CA to inappropriately "project" these conditions into *the central and interior portions of the CA where no relevant bedrock data exists*. Unfortunately, the response misses the issue in the original comment regarding NW-striking fractures and sheds no additional light on the adequacy of the overall characterization in this regard. EPA notes while Olin scolds EPA in paragraph 4 for not considering all the data and describes GW-202BR in paragraph five as being essentially unfractured, EPA notes that there were several shallowly-dipping fractures noted by the geophysicist on the log for that borehole. For example, numbered fractures 1, 3, and 4 at depths of 32.6, 33.6, and 36.4 feet were categorized by the geophysicist as "possible water bearing fractures". In contrast to other intervals of the borehole, a slight amount of flow was measured by the HPFM in this depth interval, perhaps pointing to the presence of hydraulically-significant sheeting fractures in this general vicinity? Regarding NW-striking features, the geophysicist identified a steeply-dipping feature at 131.2 feet with NW-strike (283) and steep dips to the northeast. The feature was categorized by the geophysicist as a "likely water-bearing fracture". As per EPA's original analysis, we remain concerned about the potential for migration pathways utilizing NW-striking features

with steep dip, the lack of characterization in this regard. The NW-striking feature described above identified in GW-202BR (131.2 feet) remains a specific concern and should be further evaluated. It is possible that additional features of this orientation are present in the general vicinity of GW-202BR and that borehole may or may not be optimally located in this regard. Considering the known limitations of HPFM testing generally, and the coarseness (lack of vertical resolution) of the testing program at these locations, Olin should take a more global and comprehensive look at its own data. (Please see also EPA's response to Olin's January 18, 2019 memorandum entitled, *Abandonment of Containment Area Boring OC-BB-2-2018,* to be provided separately).

Olin states in the concluding paragraph of its response, it is "not adverse" to "additional characterization and is willing to collect data that is relevant and meaningful". EPA concurs that additional characterization is the most efficacious way forward given the magnitude of data deficiencies in the CA, and collection of "relevant and meaningful" data will necessarily include high-resolution characterization efforts in the central and interior portions of the CA.

3. Additional methods shall be employed to determine groundwater flow. The geophysical investigations in the deep bedrock in the area suggest that groundwater flow is low in this area. However, a more accurate representation of groundwater flow shall be obtained via hydraulic testing (such as packer testing or liner transmissivity tests).

Olin Response to General Comment 3

Olin is willing to conduct additional evaluation as needed. The Olin and USEPA case teams will convene a meeting during January 2019 in an effort to gain consensus on remaining data gaps as well as methodology to be used to close them. Data gaps at the Containment Area will be discussed during that meeting.

Olin is not opposed to conducting hydraulic testing in the deep bedrock in the area provided the objective for data collection is clear. Note that the shallow and deep zones in GW-202BR are very low transmissivity and may not be conducive for low flow sampling. When BR-1 was drilled, the cased open bedrock borehole remained dry for an extended time. In the case of OC-BB-1, a liner transmissivity test may not be fruitful since the only and dominate transmissive fracture observed at that location is at the bottom of the borehole.

EPA Response to Olin Response to GC3

Olin's response is noted. Olin shall revisit this issue when developing a comprehensive scope of work to collect additional data in the CA.

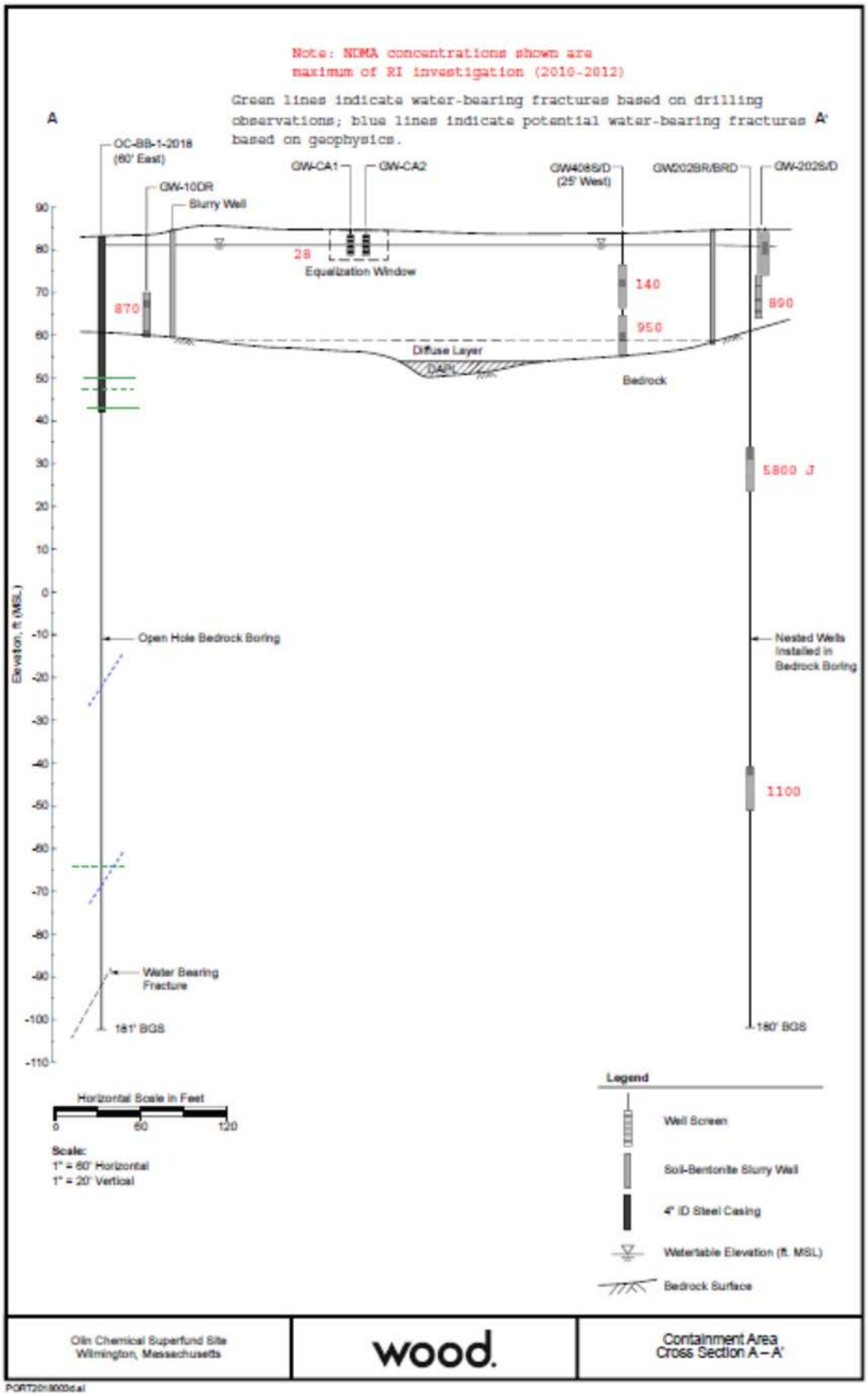
4. The bedrock boring program did not include any analytical sample results. Given that location OC-BB-1-2018 is relatively close to the edge of the diffuse layer and DAPL pool, and that location OC-BB-2-2018 is located downgradient of the DAPL and diffuse layer (and upgradient of impacted location GW-79S), Olin shall collect groundwater samples to determine if bedrock is impacted and to confirm the CSM.

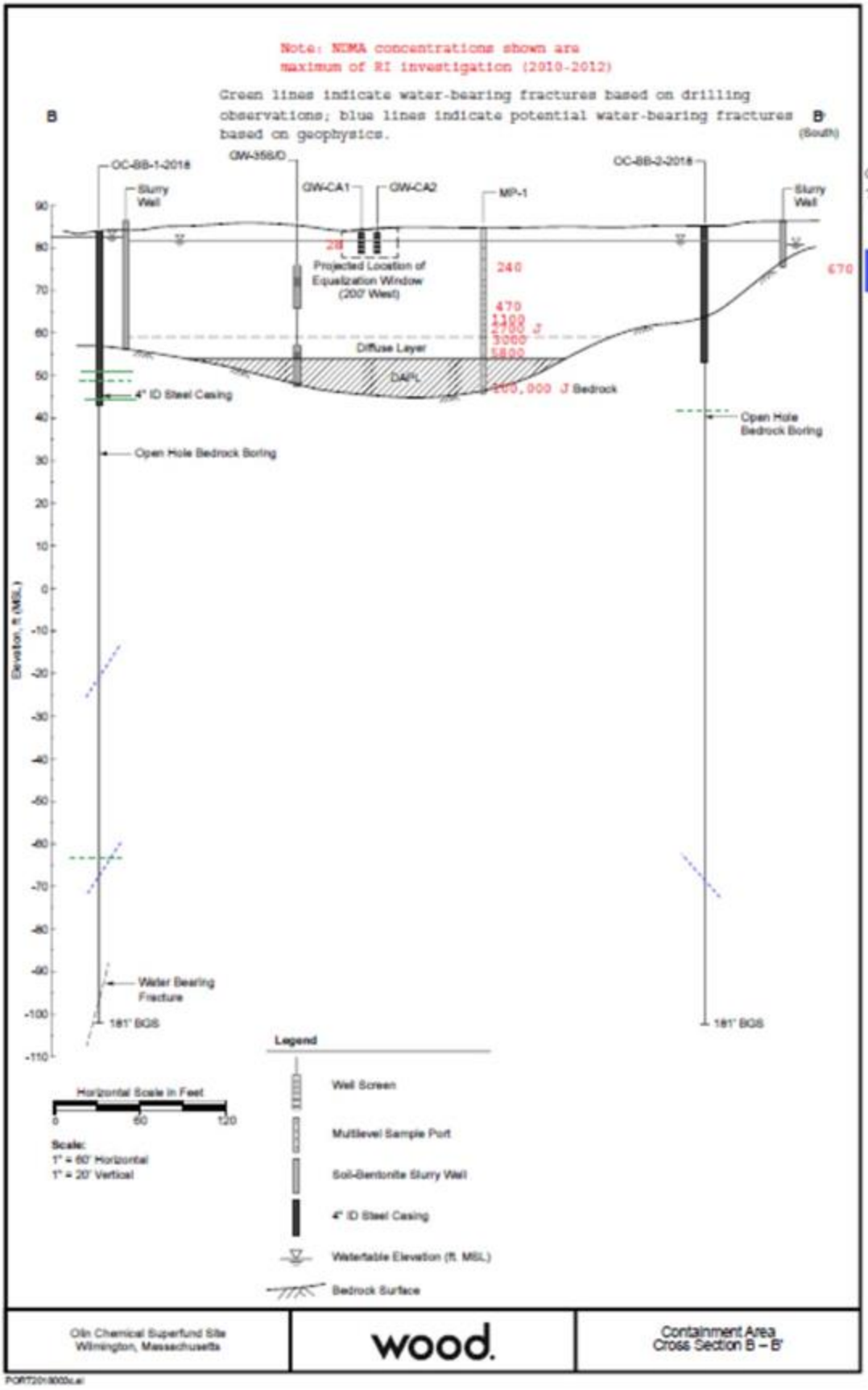
Olin Response to General Comment 4

Olin is amendable to sampling boring OC-BB-1-2018. However, boring OC-BB-2-2018 has been abandoned at USEPA's insistence. Analytical results are available from other bedrock borings in the area (e.g., GW-202BR, BR-1), which have been provided to USEPA in the past.

EPA Response to Olin Response to GC4. Olin's response is noted. Olin shall revisit this issue when developing a comprehensive scope of work to collect additional data in the CA.

5. If the bedrock were competent close to the surface, this would suggest that the elevated concentrations of contaminants such as NDMA would be from other sources instead of the containment area. NDMA concentrations have been included on the figures below to illustrate this point. Therefore, a more appropriate evaluation would have involved shallow bedrock boreholes rather than casing through the shallow bedrock zone.


Note: NDMA concentrations shown are maximum of RI investigation (2010-2012)
Green lines indicate water-bearing fractures based on drilling observations; blue lines indicate potential water-bearing fractures based on geophysics.
A
A'
OC-BB-1-2018 (60' East)
GW-10DR
Slurry Wall
GW-CA1
GW-CA2
GW406S/D (25' West)
GW202BR/BRD
GW-202S/D
28
Equalization Window
870
140
950
890
Diffuse Layer
DNAPL
Bedrock
5800 J
1100
Open Hole Bedrock Boring
Nested Wells Installed in Bedrock Boring
Water Bearing Fracture
181' BGS
180' BGS
Elevation, ft (MSL)
Horizontal Scale in Feet
0
60
120
Scale:
1" = 60' Horizontal
1" = 20' Vertical
Legend
Well Screen
Soil-Bentonite Slurry Wall
4" ID Steel Casing
Watertable Elevation (ft. MSL)
Bedrock Surface
Olin Chemical Superfund Site
Wilmington, Massachusetts
wood.
Containment Area
Cross Section A – A'

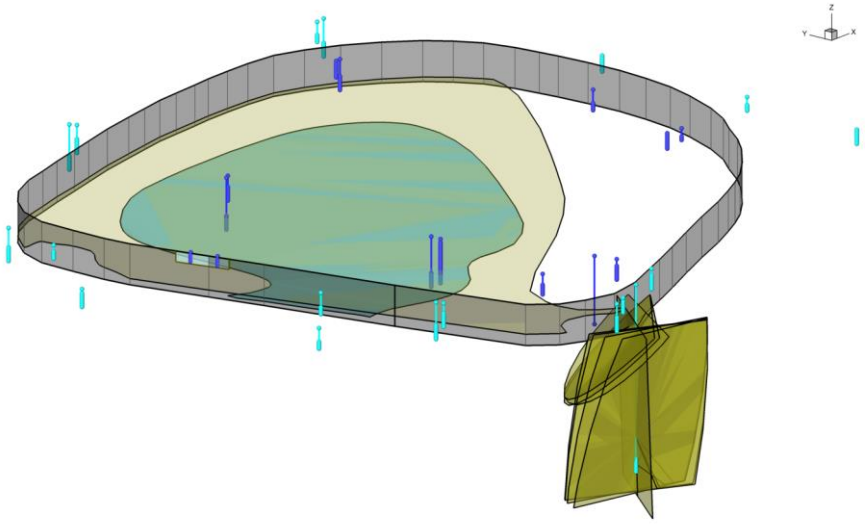

Note: NEMA concentrations shown are maximum of RI investigation (2010-2012)
Green lines indicate water-bearing fractures based on drilling observations; blue lines indicate potential water-bearing fractures based on geophysics.
B
B'
(South)
OC-BB-1-2018
Slurry Wall
GW-356/D
GW-CA1
GW-CA2
MP-1
OC-BB-2-2018
Slurry Wall
CM-79S
670
28
Projected Location of Equalization Window (200' West)
240
470
1100
2700 J
3060
5800
400,000 J Bedrock
Diffuse Layer
DNAPL
4" ID Steel Casing
Open Hole Bedrock Boring
Open Hole Bedrock Boring
Water Bearing Fracture
181' BGS
181' BGS
Elevation, ft (MSL)
Legend
Well Screen
Multilevel Sample Port
Soil-Bentonite Slurry Wall
4" ID Steel Casing
Watertable Elevation (ft. MSL)
Bedrock Surface
Horizontal Scale in Feet
0
60
120
Scale:
1" = 60' Horizontal
1" = 20' Vertical
Olin Chemical Superfund Site
Wilmington, Massachusetts
wood.
Containment Area
Cross Section B – B'

Olin Response to General Comment 5

Olin is willing to conduct additional evaluation if as needed – however, DAPL is the only source in the vicinity of Containment Area that contributed to the NDMA impacts. It should be noted that Containment Area was installed only in 2000, but the deep overburden and bedrock groundwater in the area have been impacted by DAPL for over 40 years before the slurry wall was constructed. Further, Olin's CSM for the last 20 years has been that DAPL is diffusing to the overlying groundwater. Diffuse groundwater in bedrock would also result matrix impacts through diffusion that would continue to act as a source to groundwater. .

It is relevant that the MassDEP's unconditional approval, dated March 29, 2005, for the containment wall and temporary cap construction noted the following for South Ditch surface water; "*DEP agrees that this contamination is likely not the result of leakage or failure of the containment structure. DEP believes the source of this contamination is uncontrolled migration of contamination from the Off Property West Ditch dense aqueous phase layer source area.*"

Finally, fractures encountered in GW-202BR where impacted groundwater has been observed are not oriented in a direction that "day lights" under the Containment Area. It is a possibility that impacted groundwater in the GW-202BR borehole also originates from under the off-PWD area as suggested by the oriented fracture plots below – this fracture orientation have been previously provided to USEPA.



EPA Response to Olin Response to GC5

Olin's response avoids the central issue of the inadequacy of the shallow bedrock characterization, in general, and particularly regarding the adequacy of the containment system and the potential for contaminant transport laterally beyond the CA. We concur that additional evaluation is needed and Olin shall revisit this issue when developing a comprehensive scope of work to collect additional data in the CA. For the record, the concept of matrix diffusion as an explanation is spurious without a comprehensive understanding of the interconnected fracture network at the appropriate scales of investigation, which is currently absent. Additionally, contrary to Olin's assertions, it is noted that, depending on strike length

assumed, at least two of the fracture sets includes in Olin's 3-D depiction appear to have the potential to project beneath the CA.

6. During the hydraulic pulse interference test (HPIT) study conducted to evaluate the integrity of the slurry well, a hydraulic pulse was received during the GW-6D to GW-CA3D test. In their data review, Amec suggested that the pulse could have been transmitted under the slurry wall through weathered bedrock. GeoInsight did not agree with this unfounded assertion based upon the data provided. However, Olin now appears to suggest that the bedrock in the containment cell is competent, which contradicts their earlier assertion from the HPIT test review. Simply put, Olin cannot have it both ways. If Olin now wishes to assert that the bedrock beneath the containment area is competent, then the HPIT testing indicates a failure in the slurry wall that requires additional evaluation. EPA notes that for practical purposes, there is no point in distinguishing between "weathered bedrock" and "underlying bedrock" because the slurry wall was installed to the top of bedrock – not completely through the weathered bedrock zone. Ignoring the weathered bedrock zone, as Olin does in their investigation, results in an incomplete understanding of the integrity of the containment area.

Olin Response to General Comment 6

EPA seems to have misunderstood the available data or Olin's interpretation. Olin has always acknowledged that the lack of proper HPIT results in this area could mean that there is *potential* for flow through weathered/disturbed rock below the wall. Preconstruction boring (B775) at station 7+75 is located in close proximity to the *GW-6D to GW-CA3D* profile. The as-built construction profile from the Part 2 Construction Report that was approved by MassDEP on March 29 2005 clearly shows weathered bedrock below the slurry wall constructed depth profile at this location. This information was provided in the HPIT final evaluation submitted to USEPA on September 28, 2016.

The only area where the HPIT indicated the potential for flow under the wall was on this northern arc of the wall in an area where the wall is not in contact with diffuse-layer groundwater or DAPL and the hydraulic gradient is clearly from outside the wall to inside. Just because HPIT did not produce proper data doesn't mean that Containment Area is leaking. The HPIT's poor response could be due to various factors. For example, HPIT is generally suited for confined aquifers and to verify aquifer hydraulic properties between two wells. The overburden aquifer surrounding the slurry wall is unconfined and the test was conducted to verify hydraulic properties of an impermeable slurry wall. Even with these known short comings of HPIT, Olin conducted the HPIT to verify the integrity of the wall as requested by USEPA during a meeting on July 18, 2008.

The HPIT evaluation report, which summarized and evaluated HPIT results as well as other pertinent available information, including water level data, groundwater flow direction and gradient information, the elevation of DAPL and groundwater quality data, concluded that the slurry wall was effective. The HPIT test data, results, evaluations, and conclusions were previously submitted to USEPA, which was approved by USEPA.

As Olin mentioned during the October 25th meeting, reviewing additional lines evidence confirms the integrity of the containment wall. For example, data collected from wells GW-6D and GW-CA3D for over a decade show that there is a constant inward gradient from GW-6D (high hydraulic heads outside) to

GW-CA3D (low hydraulic heads inside). The groundwater will continue to flow from outside to inside in this area. In addition to the hydraulic heads, the groundwater quality data from these wells corroborate this as well. All relevant data have been previously provided to USEPA.

EPA Response to Olin Response to GC6

The totality of information does not support Olin's contention that the slurry wall effectively contains waste and impedes groundwater flow. The apparent consensus regarding the limitations/inadequacies of the HPIT method as originally conceived to test the effectiveness of the slurry wall reinforces the need to collect additional data using updated approaches and additional methods. Cleary such approaches will, at a minimum, require consideration of 1) the bedrock/overburden interface, 2) the uppermost highly fractured and weathered rock layer, 3) shallowly-dipping fracturing within the upper 50 to 100 feet of bedrock, and 4) Steeply-dipping fractures present in all levels of the bedrock as distinct potential migration pathways not yet assessed. Olin shall revisit this issue when developing a comprehensive scope of work to collect additional data in the CA.

7. WERC's comments on the Draft OU1 and OU2 FS Report provided an analysis of the water levels in and around the containment area. The analysis concluded the water level in the containment area has a consistent slope from north to south which reflects the groundwater outside the containment area. The containment area clearly is not functioning as designed. These findings indicate that a "tilt" of the internal water contours is occurring due to the influence of the outside water table. The north side is higher, and the south side is lower in the internal water table. So, the containment area is not isolated from the outside. Flow is occurring into the area from the north and out of the containment area in the south. The well boring construction information in this memo indicates the flow may be through the weathered bedrock surface or through the bedrock fractures in the upper layers.

Olin Response to General Comment 7

It is unclear how WERC can conclude that there is a leak underneath the Containment Area just because of "tilt" of the groundwater, as the natural groundwater direction in the area is from north to south and south east – i.e., the groundwater table is naturally "tilted" from north to south. Further, it is worth noting that there is a natural groundwater divide just north of the Containment Area – which adds complexity to the groundwater conditions in that area. As USEPA may be aware, the groundwater divide fluctuates/oscillates throughout the year and the groundwater conditions must be reviewed holistically before making any conclusions. USEPA's concept of "tilt" relies only on the groundwater elevations (as presented by USEPA during a meeting on October 25, 2018) within the Containment Area. It fails to account for groundwater quality trends within and outside of the containment area. USEPA contends that the containment wall is leaking, especially in the southwest side, as the groundwater is flowing from north to south and there are impacts immediately outside of Containment Area in the south side. If USEPA's CSM is correct, we should see increasing concentration trends in wells (e.g., PZ-25) immediately outside of containment area when compared to wells inside (PZ-24). But no such increasing trends are observed for DAPL indicator compound concentrations (e.g., sulfate) for over a decade. Lack of increasing concentration trends immediately south of containment area and the presence of impacts prior to the construction of slurry wall corroborate that the wall is effective. All relevant data from PZ-24 and PZ-25 were included in the draft OU3 RI that was submitted in March 2018.

Note, Olin proposed to collect additional data to further verify containment wall integrity, in the southwest side, which is pending USEPA approval.

EPA Response to Olin Response to GC7

The totality of information does not support Olin's contention that the slurry wall effectively contains waste and impedes groundwater flow. We concur that a holistic approach is needed. Olin shall revisit this issue when developing a comprehensive scope of work to collect additional data in the CA.

8. MassDEP disagrees that monitoring well GW-202BR and BR-1 verify the competency of the bedrock. Both GW-202BR and BR-1 show Site-related contamination. The document shall be revised to discuss how the detections of contamination in these bedrock wells demonstrates that the bedrock is not competent.

Olin Response to General Comment 8

The impacts in these bedrock wells does not imply that bedrock is not competent. It should be noted that the containment wall was installed only in 2000, but the deep overburden and bedrock groundwater in the area have been impacted by DAPL for over 40 years before the containment wall was constructed. Further, two additional borings, one installed within the Containment Area immediately adjacent to the existing DAPL pool and the other immediately outside of the Containment Area on the north side installed in March 2018, encountered un-fractured and highly competent bedrock to a depth of approximately 180 and 175 feet below ground surface, respectively. .

Please see response to General Comment 2 in regard to drilling observations concerning the competency of bedrock adjacent to and within the Containment Area.

Fractures encountered in GW-202BR are very fine and very low transmissivity, to the point where the screened intervals in the well cannot be low flow sampled. Typically fractures with such small aperture have very limited strike length (Klimczak et al 2010). Fractures in this borehole are not oriented in a direction that would cause them to traverse upward under the Containment Area. These fracture orientations are more consistent with a potential connection from areas upgradient and under the adjacent off-PWD DAPL area. GW-202BR fracture orientations have been previously provided to USEPA.

BR-1 has been sampled recently in 2015 and 2017 and results for NDMA and major DAPL indicators are provided below. The concentrations of ammonia, chloride and sulfate are very low and not indicative of either DAPL or diffuse groundwater. In fact this data suggest that shallow bedrock immediately underlying the Containment Area at this location is isolated from the DAPL and diffuse groundwater above it. BR-1 and other relevant data have been previously provided to USEPA.

EPA Response to Olin Response to GC8

Please see EPA's response to GC2, above. In addition to the issues regarding the specific conditions present in GW-202BR, it is noted that it is not yet clear whether GW-202BR and/or BR-1 are optimally located to intersect key fractures potentially present in that portion of the site. Additional characterization efforts are needed in this regard. Olin shall revisit this issue when developing a comprehensive scope of work to collect additional data in the CA.

SPECIFIC COMMENTS

1. Executive summary; Page 1, 3rd ¶; The text states "The boring inside the Containment Area and immediately adjacent to the associated DAPL pool encountered un-fractured and highly competent bedrock over the entire borehole (to a depth of approximately 180 feet below ground surface (bgs). The boring outside the area had only one likely water bearing fracture, which was at a depth well below the DAPL (approximately 175 feet bgs). The borings corroborate the previous findings that bedrock underlying the Containment Area is highly competent and no additional investigation is warranted to verify the competency of the bedrock in the vicinity." EPA is unable to concur with these sweeping but inaccurate conclusions as they lack technical support or are in some cases contrary to existing information, including data from the new boreholes. For example, a very significant fracture occurs at a 32.3 feet bgs in OC-BB-2-2018, just below the base of the steel casing. The fracture has a huge aperture (32 mm), which is the largest measured in either of the two borings, as well as a demonstrable relationship to flow based on pumped HPFM data. Clearly the generalization of "un-fractured" conditions "over the entire borehole" is not accurate. Similarly, the "one likely water bearing fracture" discussed relative to OC-BB-1-2018 (at 176.0 bgs) is not the only one identified on the geophysical logs. While the fracture discussed here appears to be the largest and most significant with respect to flow, additional notable fractures were identified by Olin's geophysical contractor at 104.9, 106.3, 114.7, and 116.6 feet bgs, and drilling logs suggest the presence of additional potential fracture zones not detected by the geophysical surveys, particularly in the uppermost 70 feet of the borehole. While it is not clear what "previous findings" are supported by the current efforts, EPA disagrees with the statement that "bedrock underlying the Containment Area is highly competent and no additional investigation is warranted to verify the competency of the bedrock in the vicinity." The basis for EPA's position is presented in comments provided in this appendix as well as Appendix 1. Therefore, these statements must be deleted from the report and replaced with EPA's summary of the CSM for this area. In addition, EPA has provided comments suggesting further work needed that would help refine EPA's CSM for this area.

Olin Response to Specific Comment 1

The feature at 32.3 ft bgs at OC-BB-2-2018 that EPA is speculating is not a fracture. As requested by EPA, Olin abandoned OC-BB-2-2018 borehole in December 2018. The borehole was abandoned as per the EPA approved procedures. The procedures followed during the abandonment concluded that there is no horizontal fracture, as speculated by EPA. EPA's Hydrogeologist and their independent consultant (Nobis) oversaw the abandonment and agreed with the implemented abandonment procedures in the field. Hence, EPA"s conclusion of the presence of huge aperture at OC-BB-2-2018 is incorrect as there is no available data that show that there are significant observable fractures underneath the containment area that could lead the leakage of DAPL.

Please see response to General Comment 2 concerning rock competency and fracturing. Geologist observations during drilling an air hammer hole are qualitative and not definitive with regard to identifying fractures. They are taken into consideration when reviewing the borehole geophysical logs. Field Geologist observations are not as definitive as borehole logging data. A potential fracture that is noted by the rig geologist but not identified by the borehole logging is not an indication that borehole logs are inaccurate.

However, Olin acknowledges the data density. As discussed during the meetings on October 25 and December 10, Olin is not averse to additional characterization and is willing to collect data that is as relevant and meaningful. This issue will be covered in the January 2019 meeting (to be scheduled) between Olin and USEPA.

EPA Response to Olin Response to SC1

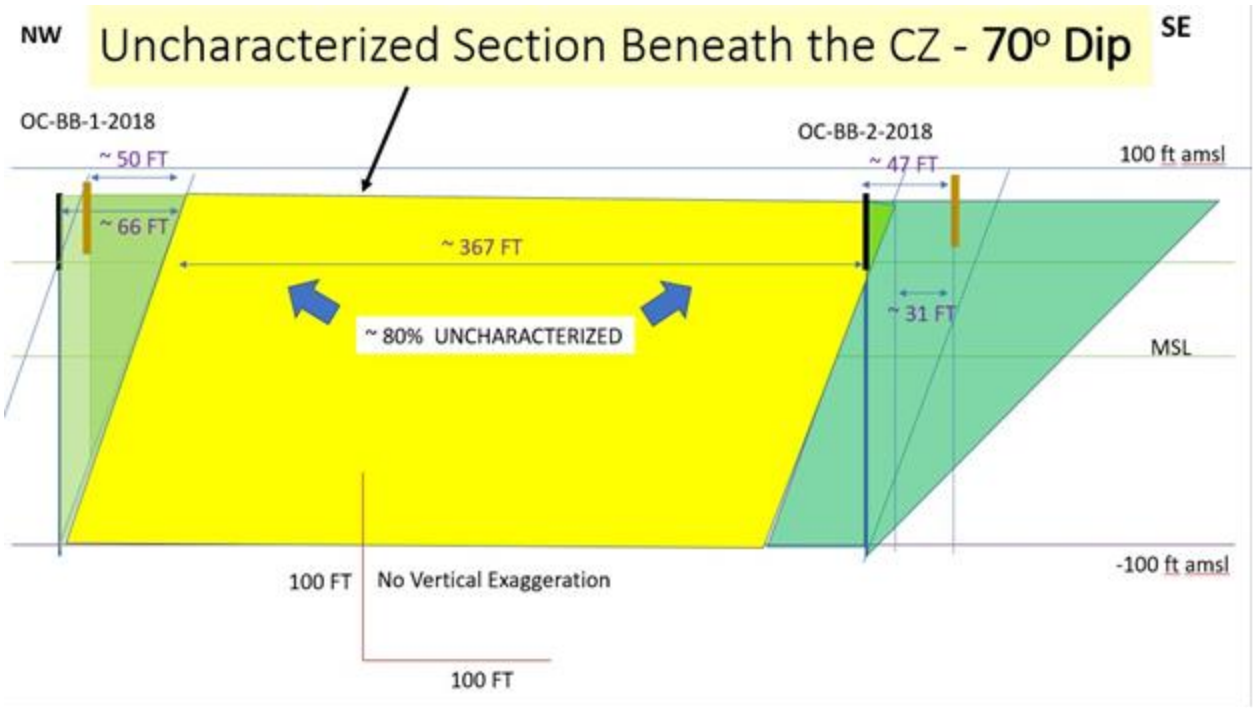
Olin's response states, "The procedures followed during the abandonment concluded that there is no horizontal fracture, as speculated by EPA." It must be clarified that it is Olin's conclusion alone (not "the procedure's") that there is no horizontal fracture whatever at this depth. While EPA concurs that the observations do not appear to support a laterally extensive fracture with the large apertures recorded by the borehole geophysical logs, the potential presence of a shallowly-dipping fracture of smaller aperture cannot be ruled out. Olin's responses to GC 2 notwithstanding, it is well known that fracture apertures measured at the borehole wall may diminish with distance into the formation. However, caliper enlargements are one of the more consistently useful diagnostic indicators of fracture presence, and larger breakouts are more commonly located in areas of more well-developed fracturing as opposed to randomly occurring in boreholes. The leakage noted by the field geologist at this depth (near the base of casing) was certainly 'real'. In any case, the presence of a fracture (or not) at ~ 32 feet bgs at OC-BB-2-2018 is a minor consideration in the larger picture. Again, Olin's response, while focusing attention to this one fracture in OC-BB-2-2018, ignores the preponderance of evidence. As such, the declarative statement which Olin conflates with its interpretation of OC-BB-2-2018, i.e., "there is no available data that show that there are significant observable fractures underneath the containment area that could lead the leakage of DAPL," again misses the point altogether. As stated in previous responses and previous EPA memoranda, there are numerous shallow fractures noted on the geophysical logs for *OC-BB-1-2018* which cannot be ignored. And while Olin asserts that, "Field Geologist observations are not as definitive as borehole logging data," EPA's earlier analysis has pointed to numerous instances where field geologists have noted indications of fractures at depths which were subsequently cased off, and therefore not included in borehole geophysical logs. This is critical information which cannot be ignored. As Olin acknowledges, additional data collection to improve data density moving forward is the logical next step, and EPA suggests revisiting these issues when developing a comprehensive scope of work to collect additional data in the CA.

2. Summary of Work Performed, Page 1, 4th ¶; The text states, "One boring, OC-BB-2-2018, was positioned along the geologic strike of the competent bedrock lithology encountered in GW-202BR to evaluate lateral geologic continuity of that lithology. The other boring OC-BB-1-2018 was completed perpendicular to geologic strike to evaluate thickness and down dip continuity of that lithology across the other side of the Containment Area." This statement is misleading at best. While it is true that OC- BB-2-2018 is generally on strike with GW-202BR, and it is also true that OC-BB-1-2018 is located generally perpendicular to strike in the down-dip direction, it is false and misleading to state that these two locations could "evaluate thickness and downdip continuity of that lithology across the other side of the Containment area." While the grossly vertically-exaggerated cross sections prepared by Wood could give such a false impression, a true-scale geologic cross section provides a vastly different story.

Even with the lack of data within the containment area itself, a true-scale cross section can be constructed perpendicular to strike to assess the adequacy of the down-dip characterization of the bedrock beneath the containment area in its simplest embodiment, as a mass of dipping layered rocks, (as Wood's generic characterization states), and the limited data available. However, the substantial vertical exaggeration in Wood's cross sections distort the true angular relationships, and interpretations made from this distorted perspective are fatally flawed. The following true-scale cross section presents a simplified version of the same information shown on Wood's B-B' cross section without vertical exaggeration. In other words, the horizontal scale is the same as the vertical. Assumed in this cross section is a consistent stratigraphic dip of 70 degrees across the area of interest. This assumption seems to be well justified based on the dips recorded in oriented logs from OC-BB-1-2018 and OC-BB-2-2018. Several important observations are immediately observed by inspection of this cross section, including the following:

- The full stratigraphic sequence across the containment area has not been fully assessed. In fact, approximately 350 feet of the stratigraphic sequence has not been assessed in any fashion. This is unacceptable as this interval is the zone directly beneath the heart of the containment area, in effect the 'sweet spot', which is the most critical towards evaluating the effectiveness of containment.
- The horizontal data gap, i.e., width along the general position of the top-of-bedrock surface, is on the order of 370 feet in the horizontal dimension, representing a lateral data gap on the order of a full-sized football field with large end zones. OC-BB-1-2018 and OC-BB-2-2018, at best, were only effective in assessing ~ 20 % of the stratigraphic section along this profile line, at best. The completeness of the characterization is even lower if one considers the third dimension.
- Since there has been effectively no penetration of the rocks beneath the central portion of the containment area subsurface, the fracture characteristics of this critical interval are unknown. It is inappropriate to assume that these rocks have the same characteristics as those penetrated by OC-BB-1-2018 and OC-BB-2-2018. Actual data is needed.

*Note "CZ" in the figure below refers to containment zone or area.



Olin Response to Specific Comment 2

Olin acknowledges the sparsity of data in this area, but the issue is not about the number of points per linear foot, but rather what is required to accurately interpret the system and develop a robust CSM, which is a different question. As discussed during the meetings on October 25 and December 10, Olin is not averse to additional characterization and is willing to collect data that is as relevant and meaningful. However, USEPA appears to be overanalyzing the information that was presented. The presentation of cross-sections with exaggerated vertical scales is industry practice. Even USEPA has requested to present such vertical geologic and quality data in a cross-sectional manner (see USEPA request to Olin dated November 5, 2018).

The intent of the cross-section, which USEPA is referring, is to show that the available data show bedrock underneath the containment area is competent. Note, recently abandoned OC-BB-2-2018 was installed within the containment area, but on the periphery of the DAPL pool. The data collected during that boring installation and abandonment corroborate the data collected to-date that the bedrock underneath the Containment Area is competent. Further, the scale of the cross section drawn has nothing to do with the referenced statement pertaining to the location of the boreholes. The statement "*One boring, OC-BB-2-2018, was positioned along the geologic strike of the competent bedrock lithology encountered in GW-202BR to evaluate lateral geologic continuity of that lithology. The other boring OC-BB-1-2018 was completed perpendicular to geologic strike to evaluate thickness and down dip continuity of that lithology across the other side of the Containment Area"* is correct. OC-BB-2 confirmed the sparsely fractured / fractured quartzite continued along strike on the south side of the Containment Area. OC-BB-1 indicated that a similar lithology was present across dip, on the other side. A reasonable geologic inference is that the same or similar lithology is present between the three boreholes.

However, as previously mentioned, Olin proposed to install at least one bedrock boring through the on-site DAPL pool to verify bedrock integrity directly underneath the Containment Area (see Olin's letter dated November 8, 2018). Olin's proposal is pending EPA approval. As mentioned in the November 8 letter, Olin would seek USEPA input and approval of a relevant work plan prior to installing such boring(s). This issue will be discussed during the January 2019 meeting.

EPA Response to Olin Response to SC2

Olin's response is factually and logically flawed and is rejected outright. As an example, the fact that vertically-exaggerated cross sections are common in the environmental industry does not justify inappropriate use or erroneous conclusions drawn from them. EPA in no way endorses such practices. The original comment stands in its entirety. The matter will be revisited in relation to developing a work plan which comprehensively assesses bedrock conditions beneath the CA. EPA is previously on record indicating that the single well Olin mentions in the response for this purpose here is insufficient for many reasons, including those articulated in the original comment.

3. Page 2 and 3. Bedrock Boring Installation: OC-BB-2-2018 Olin states the following: "The overburden soils were composed of sand with large amounts of gravel and cobbles – however, auger refusal was encountered at approximately 17 feet bgs in what appeared to be cobbles and boulders that included weathered bedrock. The six-inch air hammer was then used to clean out the casing and attempt to drill to competent rock. The borehole was quickly advanced, through cobbles, boulders, till, and weathered bedrock, to approximately 27 feet bgs where competent bedrock was encountered. The borehole was advanced to 30 feet bgs. Repeated attempts to clean out the borehole to 30 feet were unsuccessful due to cave in of material and approximately 6 feet of material could not be removed from the bottom of the borehole. The four-inch steel casing was hammered to refusal at 28 feet, and grout was tremied into the borehole annulus to attempt to seal off the casing from the overburden." In the construction of well OC-BB-2-2018, boulders and weathered bedrock were encountered at 17 bgs but the steel casing was carried through to a depth of 30 bgs. So, for this well, the casing went through 13 feet of bedrock before the rock was judged to be competent not to need a casing. The construction of this well also included cave-in. Again, this is not how the slurry wall was constructed for the Containment Area. For both wells, over 10 feet of bedrock had to have steel casing. This indicates the groundwater can easily flow under the slurry wall in the weathered and fractured upper layers of the bedrock.

Olin Response to Specific Comment 3

The slurry wall, where it was constructed, was designed to contain the migration of impacted groundwater from the on-property source area. The bedrock underneath the containment area is competent and will inhibit the vertical migration underneath the slurry wall. The boring log for OC-BB-2-2018 indicate fractured rock OR boulders, hence the casing was set deeper. Presence of boulders at the shallower depths is common in the area (as observed in other borehole installations in the past). Relevant boring logs for borings in the Containment Area show that basil till in the area contains many boulders and cobbles. While the boulders may give the appearance of weather bedrock, they are not the weathered bedrock surface. Installing casing in bedrock and not in boulders is industry practice. Further, the slurry

wall installation is not the same as installing a borehole. USEPA is now raising concerns about slurry wall, which was previously approved by MassDEP (see Construction RAM Completion Statement, and its approval letter by the MassDEP dated March 29, 2005). With respect to groundwater flowing under the slurry wall, see Olin response to general comments 6 and 7 above.

EPA Response to Olin Response to SC3

Olin's response is unpersuasive and offers no new insights or information. The fact that DEP approved the Construction RAM Completion statement relative to the slurry wall in 2005 is of little present importance or relevance given the questions which have arisen since then from a variety of data sets germane to the *performance* of the slurry wall vis-à-vis containment of contaminated groundwater. At least four pathways are not addressed by the current containment system/slurry well, including, 1) migration along the bedrock/overburden contact, 2) migration within the highly fractured and weathered uppermost bedrock interval, 3) migration within shallowly dipping 'sheeting' fractures in the uppermost 50 to 100 feet of bedrock, and 4) migration via moderately-dipping and/or steeply-dipping fractures present in all levels of the bedrock, including those potentially affecting the top-of-bedrock surface. While other potential modes of slurry wall failure, e.g., "by-pass" or "short-circuiting" via complex pathways cannot be ruled out, future characterization and performance assessment efforts must comprehensively asses the four pathways listed above.

4. Borehole Geophysical Logging, Page 3 last para.; (OC-BB-1-2018); The text states "Overall, the bedrock is competent, and the observed fractures are well below the bottom of the DAPL in the Containment Area **(Cross Section A-A')**." This statement is at odds with the facts. A compilation of measured or suspected fractures based on data provided in this memorandum is included below in table format. Numerous fractures were identified in all levels of the boring. Several fracture zones, likely to be shallowly dipping sheeting fractures where identified at 32 and 35.5 feet bgs but were cased-off by the cemented steel casing. Moreover, the sole fracture Wood chose to include on Cross Section A-A' (numbered fracture 102) is the deepest, but far from the only fracture identified. Despite its depth and position near the bottom of the borehole, this fracture is clearly significant hydraulically and if projected up-dip, would appear to intersect the DAPL pool in the central part of the containment area.

Olin Response to Specific Comment 4

USEPA analysis of the borehole geophysical logs as provided in its tabulated data is incorrect and is in conflict with the geophysical logs. Please see response to General Comment 2. Further, USEPA's conclusion of "projected up-dip, would appear to intersect the DAPL pool in the central part of the containment area" is highly speculative as no data currently exists to support EPA's conclusion. Further, recently abandoned OC-BB-2-2018 was installed within the containment area, but on the periphery of DAPL pool. The data collected during the boring installation and abandonment corroborate the data collected to-date that the bedrock underneath the containment area is competent.

However, as discussed during the meetings on October 25 and December 10, Olin is not averse to additional characterization and is willing to collect additional data. Olin proposed to install at least one bedrock boring through the on-site DAPL pool to verify bedrock integrity directly underneath the containment area (see Olin's letter dated November 8, 2018). Olin's proposal is pending EPA approval. As

mentioned in the November 8 letter, Olin would seek EPA input and approval of a relevant work plan prior to installing these boring(s).

EPA Response to Olin Response to SC4

Olin's response is unpersuasive and offers no new insights or information. EPA's original comment pertained to OC-BB-1-2018. As such, in this instance, Olin's discussion of OC-BB-2-2018 is particularly glaring in as much as it not only misses the target, but neither is it even "*in the ball park*" given its location some hundreds of feet southeast of OC-BB-1-2018. It must be emphasized that the CA is a huge stadium-sized area, which will require more than a handful of borings to characterize the complex bedrock beneath it. As stated in numerous responses above, neither of the two boreholes discussed here speak directly to conditions in the central/interior portions of the CA. Additional investigations are needed here, and as EPA has stated previously, more than one new bedrock boring will be required. (Please see also EPA's response to Olin's January 18, 2019 memorandum entitled, *Abandonment of Containment Area Boring OC-BB-2-2018,* to be provided separately).

5. Borehole Geophysical Logging, Page 4, 1st para.; (OC-BB-2-2018); The text again concludes "In general it appears that bedrock in OC-BB-2-2018 is un-fractured and highly competent over the entire borehole." Again, this conclusion conflicts with the totality of the information contained in the memo. For example, the drilling logs noted "possible fractures" based on drilling response at 43, 58, and 115 ft bgs. The NW-striking fracture detected at 138.6 ft bgs has the potential to influence the containment area depending on its strike length. Clearly, the huge fracture identified at 32.3 ft bgs cannot be so easily dismissed. The report states, "Although the composite log correctly identifies this as a "likely transmissive zone", it is not a fracture." While the borehole may have been preferentially enlarged in this zone (by the drilling process) due to the presence of a fractured zone here, there is no basis for concluding that there is not a fracture here. Issues regarding the failed casing installation at this location have been summarized in a memo provided separately to Olin. In any case, EPA believes there is ample technical justification to conclude that the fracture at 32.3 ft bgs is "real", naturally-existing but enlarged due to the drilling process, and the borehole is affected by leakage around the casing as confirmed by the text here, "The OTV log clearly shows the separation between the steel casing and the bedrock surface within the bedrock socket." After this leaking casing situation is corrected, it will be necessary to reexamine this depth interval under more carefully controlled conditions to determine the true nature and extent of shallow fracturing here, and most importantly whether it may represent a pathway through/beneath/beyond the containment area.

Olin Response to Specific Comment 5

The feature at 32.3 ft bgs at OC-BB-2-2018 that EPA is referring is not a fracture. The feature was confirmed not be a fracture during the boring abandonment in December 2018. The borehole was abandoned as per the EPA approved abandonment Work Plan dated November 13, 2018. Further, EPA's Hydrogeologist and their independent consultant oversaw the abandonment and agreed with the implemented abandonment procedures in the field. Hence, EPA"s conclusion of the presence of huge aperture at OC-BB-2-2018 is incorrect. Hence, EPA's suggestion "to determine the true nature and extent of shallow fracturing here" is unwarranted as no such fracture exists as proven by the observations and outcome from the abandonment of OC-BB-2-2018.

Please also note the chemical results from BR-1, presented in response to General Comment 8. This well, located in close proximity to abandoned OC-BB-2-2018, is an open shallow bedrock borehole and essentially un impacted.

EPA Response to Olin Response to SC5

Olin's response here offers no new insights or information not already provided. While the presence of a large-aperture fracture at 32.3 feet bgs at OC-BB-2-2018 has been refuted, the potential presence of a fracture here of smaller aperture with limited lateral extent cannot be definitively ruled out. Again, the original comment addressed potential fracturing at a variety of depths as indicated by the data, and exclusive focus on the situation at 32.3 feet bgs misses the point. In addition to the fractures identified in the geophysical logs, the potential presence of fractures within the cased-off portions of OC-BB-2-2018 and BR-1 cannot be ruled out. (Please see also EPA's response to Olin's January 18, 2019 memorandum entitled, *Abandonment of Containment Area Boring OC-BB-2-2018,* to be provided separately).

6. Conclusions with Respect to Containment Area Conceptual Site Model: The text states that "The recently installed borings corroborate the previous findings from GW-202BR and BR-1 that bedrock underlying the Containment Area is competent and no additional investigation is warranted to verify the competency of the bedrock in the vicinity." This conclusion is unsupported and is rejected. In the comments above, EPA has presented a different CSM for the containment area which integrates a broader spectrum of data from a variety of sources not considered by Wood. Wood's interpretation has an unjustified bias for the ubiquitous presence of 'quartzite' as essentially the 'default' rock unit beneath the containment area, despite little to no real information beneath the containment area and conflicting information from other sources. For example, published geologic mapping (e.g., the large- scale bedrock geologic map presented at recent meetings) for the area shows the quartzite unit as only occupying a small portion of the containment area. Moreover, the unit is mapped as part of a well- defined fold hinge in the containment area. While the actual position of the quartzite layer within the containment area is not well constrained due to the limited data, it does appear to generally hold up the southern flank of the containment area. Previous field investigations identified diorite and gabbro as the primary rock type (not quartzite). However, even if this is true, Wood's interpretation stretches the data, "OC-BB-2-2018 drilling and borehole geophysical logging supports a conclusion that the quartz rich lithology is laterally continuous along the south side of the on-Property DAPL pool." On what basis is the unit determined to be continuous? More importantly, Wood's CSM appears to hold an unjustified bias that quartzite units are essentially unfractured. There is no basis for this bias, and the facts appear to be contradictory to Wood's assertions. For example, the conclusions state:

> "The orientation of fracture features is predominantly parallel to relict bedding (foliation) of the bedrock which strikes north easterly and dips moderately to steeply (50-80 degrees) toward the northwest. The direction of groundwater flow is from the northwest to the southeast, perpendicular to the orientation of bedrock foliation underlying the Containment Area. Fractures parallel to this groundwater flow direction do exist but are sparse and not generally correlated with identified transmissive zones. Therefore, the transmissivity across bedrock

> underlying the Containment Area in the direction of groundwater flow is expected to be extremely low and the fracture network, to the extent it exists, is not well connected."

Again, this statement represents a selective application of the facts. As noted in the previous comments, both OC-BB-1-2018 and OC-BB-2-2018 both intersected NW-striking steeply dipping fractures that the geophysical subcontractor designated as noteworthy. For each of these boreholes, if projected, the NW-striking features have the potential to sub-crop within the containment area, potentially affecting the DAPL zone.

The conclusions contain other errors and distortions. For example, it is stated that,

> "OC-BB-1-2018 drilling and borehole geophysical logging indicates that the thickness of this lithology extends to the far side of the DAPL pool within the Containment Area and is therefore expected to underlie the DAPL pool. Based on drilling observation (primarily penetration rates), there may be zones in the lithology intercepted by OC-BB-1-2018 that are not as siliceous indicating the lithology mineral composition is changing gradually in stratigraphically higher sections (to the northwest); however, those zones with less quartz were also not fractured

As noted in the analyses presented above, the lithologies penetrated by OC-BB-1-2018 do not extend to the far side of the DAPL pool within the containment area. There is simply no geologic basis for this statement. About stratigraphy, it is interesting that the text notes that, ", there may be zones in the lithology intercepted by OC-BB-1-2018 that are not as siliceous indicating the lithology mineral composition is changing gradually in stratigraphically higher sections (to the northwest)". Again, this conclusion is uniquely one-sided. What about the stratigraphically lower sections to the southeast (below the central part of the containment area)? These remain unassessed. The stratigraphy beneath the containment area is largely unknown and is likely more highly fractured due to the location within the core of a fold hinge as well as the presence of a NE-trending strike-parallel depression on the bedrock surface here, which also may correlate with a stratigraphic zone of higher fracture density.

As noted above, additional work is needed to assess the containment area. The data collected thus far suggests that there is a "sweet spot" beneath the central part of the containment area that is likely a large conduit for migration out of the containment area and further work targeted at this area would greatly enhance the CSM.

Olin Response to Specific Comment 6

USEPA's conclusion of the presence of "a "sweet spot" beneath the central part of the containment area that is likely a large conduit for migration out of the containment area" is highly speculative as there is no data to prove or reject USEPA's conclusion. Further, recently abandoned OC-BB-2-2018 was installed within the containment wall, but on the periphery of DAPL plume. The data collected during that boring installation and abandonment corroborate the data collected to-date that the bedrock underneath the

containment area is competent. EPA is raising concern that Olin's conclusions far reaching using limited data when EPA's CSM and conclusions are also using the same "limited" data set.

However, as discussed during the meetings on October 25 and December 10, Olin is willing to conduct additional characterization to further refine the CSM.

EPA Response to Olin Response to SC6

Olin's response here offers no new insights or information not already provided, but simply amplify the need to collect additional data within the central and interior portions of the CA.

7. Geophysical and borehole Logs for OC-BB-1-2018; The borehole logs for OC-BB-1-2018 indicate numerous prominent features of interest. Likely fractures based on log responses (interpreted by the geophysical subcontractor) are highlighted in yellow on the logs and are summarized in the following table. It should be noted that each of the three major classes of fracture types discussed above are represented in each of the borings:

    - Potential sheeting fractures are shown in rust colored font.
    - NW-striking steeply-dipping joints are displayed in purple font.
    - NE-striking fractures are shown in red font.

Comments above discuss these various fracture types and orientations in greater detail and the context of the investigation, efficacy of the containment area, etc.

Feature Number	***Depth Ft btoc***	***Strike***	***Dip Direction***	***Dip angle***	***Aperture (mm)***	***Comment***
NA	*27-29*					*Weathered Bedrock (Drill log)*
NA	*32*					*Drill Log: Fracture; (Orientation unknown)*
NA	*35.5*					*Drill Log: Possible Fracture; (Orientation unknown)*
2	*43.2*	*218 (NE)*	*308 (NW)*	*26*	*< 1*	*Sheeting Fracture?*
3	*45.6*	*224 (NE)*	*314 (NW)*	*14*	*< 1*	*Sheeting Fracture?*
4	*46.0*	*243 (NE)*	*333 (NW)*	*15*	*< 1*	*Sheeting Fracture?*
8	*50.7*	*199 (NE)*	*289 (NW)*	*17*	*5*	*Sheeting Fracture? (note large aperture)*
10	*53.5*	*227 (NE)*	*317 (NW)*	*27*	*< 1*	*Sheeting Fracture?*
12	*55.9*	*210 (NE)*	*320 (NW)*	*30*	*< 1*	*Sheeting Fracture?*
14	*60.6*	*196 (NE)*	*286 (NW)*	*24*	*< 1*	*Sheeting Fracture?*
16	*67.1*	*84 (ENE)*	*174 (NW)*	*7*	*4*	*Sheeting Fracture? (note large aperture)*
NA	*67*					*Drill Log: Possible Fracture; (Orientation unknown)*
18	*68.1*	*N27E*	*287 (NW)*	*8*	*3*	*Sheeting Fracture? (note large aperture)*
46	*101*	*244 (NE)*	*334 (NW)*	*25*	*< 1*	*Sheeting Fracture?*
48	*104.9*	*N45E*	*315(NW*	*72*	*2*	*Subparallel to*
49	*106.3*	*N36E*	*306(NW*	*72*	*2*	*Subparallel to*

57	114.7	N66W	204 (SW)	86	3	Sub-vertical; cross cuts
60	116.6	N37E	307(NW)	72	4	Subparallel to
63	118.2	284 (NW)	14 (NE)	28	5	Sheeting Fracture? (note large aperture)
NA	147					"possible soft zone (Drill Log)
NA	153-171					"no observed fractures but some areas of soft/rapid drilling" (drill log) [stratigraphic-compositional change?]
102	176.0	N36E	306(NW)	66	10	Subparallel to

Geophysical and borehole Logs for OC-BB-2-2018; The borehole logs for OC-BB-2-2018 indicate numerous prominent features of interest. Likely fractures based on log responses (interpreted by the geophysical subcontractor) are highlighted in yellow on the logs and are summarized in the following table. It should be noted that each of the three major classes of fracture types discussed above are represented in each of the borings:

- Potential sheeting fractures are shown in rust colored font.
- NW-striking steeply-dipping joints are displayed in purple font.
- NE-striking fractures are shown in red font.

Comments above discuss these various fracture types and orientations in greater detail and the context of the investigation, efficacy of the containment area, etc.

Feature Number	**Depth Ft btoc**	**Strike**	**Dip Direction**	**Dip angle**	**Aperture (mm)**	**Comment**
5	32.3	225(NE)	315	5	34	Sheeting
NA	43					"possible fracture at 43 ft BGS based on air hammer (drill log)"
NA	58					"possible fracture based on air hammer (~
59	95.6	223(NE)	313 (NW)	29	4	Sheeting Fracture? (note large aperture)
NA	115					"possible fracture (based on air hammer) ~ 115 ft"
102	138.6	292(NW)	22 (NE)	64	2	Steeply-dipping; cross cuts
103	139.2	212 (NE)	302	58	3	Subparallel to

Olin Response to Specific Comment 7

USEPA's conclusions about fractured bedrock beneath the central part of the Containment Area that is likely a large conduit for migration out of the containment area" is highly speculative as there is no data to support this conclusion. Further, the feature at 32.3 ft bgs at OC-BB-2-2018 that EPA is referring is not a fracture. The absence of fracture was confirmed during the boring abandonment in December 2018. The borehole was abandoned as per the EPA approved abandonment Work Plan dated November 13, 2018. Further, EPA's senior hydrogeologist and their independent consultant oversaw the abandonment and agreed with the implemented abandonment procedures in the field. Hence, EPA's conclusion of the presence of huge aperture at OC-BB-2-2018 is incorrect and baseless.

However, Olin acknowledges the sparsity of data in the area. As discussed during the meetings on October 25 and December 10, Olin is not averse to additional characterization and willing to collect data that is as relevant and meaningful to develop the appropriate answer to this question and complete the CSM. As previously mentioned, Olin proposed to install at least one bedrock boring through the on-site DAPL pool to verify bedrock integrity directly underneath the containment area (see Olin's letter dated November 8, 2018). Olin's proposal is pending EPA approval. As mentioned in the November 8 letter, Olin would seek EPA input and approval of a relevant work plan prior to installing such boring(s).

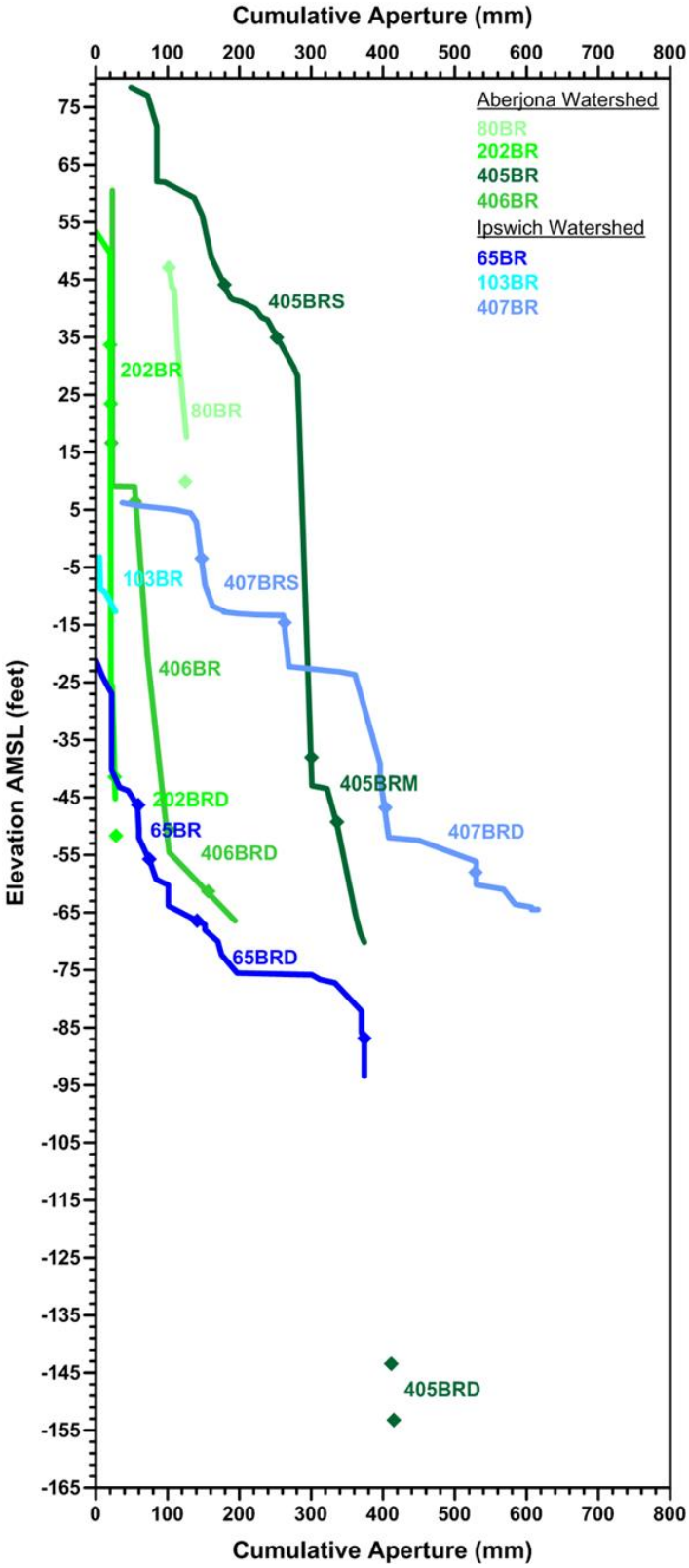
EPA Response to Olin Response to SC7

Olin's response here offers no new insights or information not already provided, but simply amplifies the need to collect additional data within the central and interior portions of the CA. Additional investigations are needed here, and as EPA has stated previously, it is anticipated that the level of effort for such investigations is well beyond the single borehole Olin proposes in the response.

References

Klimczak, C., Schultz, R., Parashar, R., and Reeves, D., 2010. Cubic Law with Aperture-Length Correlation: Implications for Network Scale Fluid Flow. Hydrology Journal (2010), 18: 581-862

FIGURE 1: Cumulative Aperture Plot



APPENDIX 5

EPA Comments on Draft Baseline Human Health Risk Assessment, Operable Unit 3 (March 30, 2018) Olin Chemical Superfund Site, Wilmington, Massachusetts

GENERAL COMMENTS

1. Section 6.0 of the Draft OU3 RI Report, summarizing the Draft OU3 Baseline Human Health Risk Assessment ("BHHRA"), states, "Aside from the scenarios evaluated, there are no other identified potential groundwater source areas in the Aberjona watershed within the extent of groundwater impacts associated with the Site (i.e., within the extent of OU3 groundwater)." The BHHRA does evaluate the existing potable wells with the Aberjona watershed, but fails to acknowledge the potential for future use of groundwater. EPA has commented numerous times that the BHHRA MUST include an evaluation of groundwater within the Aberjona watershed as a potential future potable source. Impacts to existing monitoring wells located within the Aberjona watershed are potentially significant and the MassDEP has determined that groundwater throughout the study area, including both the Ipswich and Aberjona watersheds, is of "HIGH USE AND VALUE," indicating the potential for potable use. Because the BHHRA continues to exclude this pathway, the BHHRA is disapproved. The BHHRA must be resubmitted with a full evaluation of an exposure pathway that includes the future use of the portion of the Aberjona watershed that lies within the OU3 study area as a potable source.

Olin Response to General Comment 1

The Revised Draft BHHRA submitted to USEPA on December 18, 2018 evaluates hypothetical future potable use of the portion of the Aberjona watershed that lies within the OU3 study area (overburden and bedrock groundwater). As noted in the comment above, there are several regulatory and technical reasons why this scenario was not included in the previous Draft BHHRA and those reasons are summarized below. The inclusion of the evaluation of the hypothetical future potable use of the portion of the Aberjona watershed that lies within the OU3 study area (overburden and bedrock groundwater) does not negate the reasons summarized below and it should not be interpreted to mean or even suggest that all of the groundwater within that the portion of the Aberjona watershed that lies within the OU3 study area (overburden and bedrock groundwater) should be remediated to conditions suitable for potable use.

We acknowledge U.S. EPA's position that the Aberjona aquifer be evaluated as a potable source. The current existing potable private wells that are located within the Aberjona are evaluated for potable use (ingestion of drinking water and dermal contact and inhalation during showering). However, the area of the Aberjona aquifer that is located within the Olin Wilmington Site is a low yield aquifer. Low yield aquifers are not considered by MassDEP to be potential drinking water source areas, and are not, under MassDEP's groundwater classifications, identified as GW-1 areas (i.e., potential drinking water source areas). This is stated in MassDEP's Use and Value Determination for the Olin Wilmington site, as follows: "Areas within the delineated Zone II across the northern portion of the Site [i.e., the Ipswich aquifer] are classified as GW-1 as a current drinking water source area. Additionally, areas within 500 feet of any private wells [applicable to private wells in either the Ipswich or the Aberjona aquifers] are also considered GW-1 areas…The remainder of the Site groundwater [i.e., the portion outside the Zone II and not within

500 feet of any private well] is categorized as GW-2/GW-3 [applicable to a potential vapor intrusion pathway and all waters of the Commonwealth, respectively]." The Use and Value Determination states that the groundwater risk evaluation for the Site should include "Active and Potential drinking water;" however, this would necessarily apply only to those portions of the Site that are considered potential drinking water source areas (i.e., are classified as GW-1), which the portion of the Aberjona within the Site is not (with the exception of areas within 500 feet of private wells on Cook and Border Avenue (and possibly further upgradient), which have already been assessed for potable use in this draft BHHRA). The private wells have been evaluated in the BHHRA and the area upgradient of those private wells has also been evaluated for potable use based on the data from the cores of the overburden and bedrock plumes within the Aberjona. The understanding of groundwater use conveyed by the Use and Value Determinations prepared by MassDEP; in cases where the Use and Value Determination identifies the site aquifer as a low yield aquifer, the list of risk evaluation scenarios does not include use of the groundwater for active/potential drinking water (examples of these include the Use and Value Determinations for the Industriplex site in Woburn, the Silresim site in Lowell, the Norwood PCBs site in Norwood, and the Hatheway and Patterson site in Mansfield). Further, during discussions of risk management for the Aberjona watershed at the December 10, 2018 meeting, MassDEP indicated that they had not advocated cleanup to GW-1 (drinking water) Standards throughout the whole of the Aberjona watershed.

EPA response to Olin Response to General Comment 1

Olin has included the requested evaluation of groundwater within the Aberjona watershed as a potential future potable source in the Revised Draft BHHRA, dated December 2018. EPA concurs with this evaluation.

2. The revised Draft OU3 BHHRA shall be incorporated into the revised Draft OU3 RI Report (not a separate deliverable).

Olin Response to General Comment 2

Because the schedule for the submittal of the revised Draft OU3 RI Report has been extended, the Revised Draft BHHRA was submitted to USEPA on December 18, 2018 as a stand-alone deliverable.

EPA response to Olin Response to General Comment 2

The finalized BHHRA shall be incorporated into the finalized OU3 RI Report.

SPECIFIC COMMENTS

1. Section 1.0, page 1-2: Olin defines "chemicals of interest" or COIs as "chemicals that have been associated with the former facility (as a raw material, product, or a constituent of waste streams or accidental releases) and that have been released to one or more environmental media." The BHRRA shall be modified to follow EPA guidance to identify "Contaminants of Concern" or COCs and shall use EPA's definition of COCs. NDMA, as well as other contaminants detected in DAPL, shall be included in the list of COCs.

Olin Response to Specific Comment 1

For the purposes of the Olin Wilmington reports, the OU1/OU2 RI used the term "COIs" as is described in the comment above. As has been discussed previously, "COI" was used simply to identify those constituents that are known to be Site-related. The OU3 Draft BHHRA utilized this language as well to maintain consistency between the OU documents. Despite references to COIs in the Draft BHHRA, the Draft BHHRA has considered any chemical detected in OU3 media within its scope, and used criteria consistent with current CERCLA guidance to screen these data and to identify COPCs, which are the chemicals that were carried through the risk assessment and evaluated for potential human health risks. The list of chemicals evaluated in the Draft BHHRA and in the Revised Draft BHHRA was not limited to the list referred to in the Draft OU3 RI Report as COIs.

As a point of clarification, the term "Contaminants of Concern" (COCs) should not be used interchangeably with the BHHRA term "Contaminants of Potential Concern (COPC). The term "Contaminants of Concern" is used in USEPA Risk Assessment Guidance For Superfund (Parts A and B) to describe those COPCs that are identified, for media of concern, by the BHHRA, as risk contributors for which Preliminary Risk Goals should be calculated and that should be considered in development of and evaluation of remedial alternatives. Minor clarification has been added to the text of the Revised Draft BHHRA to reinforce these concepts.

EPA response to Olin Response to Specific Comment 1

EPA concurs with the response.

2. Section 1.0 page 1-2: The first sentence of the last paragraph states: "There are no identified ecological receptor exposures to groundwater." This sentence should be removed because benthic infauna is exposed to groundwater as it emerges into surface water in the South Ditch. Sediment toxicity tests showed that there was toxicity in sediment samples to benthic test organisms even after the laboratory water overlying the test sediment in test containers had been purged of ammonia. The cause(s) of toxicity were not determined; however, given the initial concentrations of ammonia in the laboratory test containers, it is likely that ammonia in groundwater is contributing to the toxicity because they exceeded the National Recommended Water Quality Criteria for ammonia. In the absence of further ecological risk assessment and measurement of contaminants in groundwater adjacent to or under the bed sediments of the South Ditch to identify the chemicals that caused the toxicity, EPA concludes that the groundwater entering South Ditch poses an unacceptable ecological risk in South Ditch. Therefore, this document shall be revised to include this conclusion and the Source Control FS shall develop remedial alternatives for reducing the toxicity to acceptable levels.

Olin Response to Specific Comment 2

Page 2 of the Revised Draft BHHRA text includes the statement: "The 2015 BERA concluded that adverse effects to ecological receptors may be possible for Upper South Ditch surface water and for lower South Ditch surface water and sediment."

EPA response to Olin Response to Specific Comment 2

Olin does not agree with EPA's comment and does not provide any new information to support Olin's position, presumed by EPA to be that the use of language that adverse effects "may be possible" could be interpreted to mean that adverse effects are only possible, rather than EPA's position that, in the absence of further information, adverse effects are probable. EPA's position that adverse effects are probable must be added to the document. EPA suggests that language similar to the following sentence be added: "EPA concludes that adverse effects are not only possible, but are probable, in the absence of any information other than the fact that toxicity tests showed adverse effects."

3. Section 1.3.3, pages 1-9 to 1-14. This BHHRA has used deed restrictions and the MCP's definitions of drinking water source areas to determine groundwater usage exposure scenarios. Based on this approach, groundwater within the Aberjona River watershed (except for private wells and a 500-foot radius around each of these wells), including the groundwater beneath most of the Olin property, is considered for non-potable uses only (irrigation, vapor intrusion, contact during excavation). The BHHRA includes the 2010 Massachusetts DEP Groundwater Use and Value Determination, which states: "Because a portion of the Site falls within a GW-1 area, (the Zone II to the north) and the close proximity to private drinking water wells to the southeast and the GW-1 potential drinking water source area to the south, and in light of the factors contained in EPA's Final Groundwater Use and Value Determination Guidance, the Department supports a high use and value for the Site area aquifer." Olin presented potable use exposure scenarios for private wells and the Ipswich River watershed aquifers and non-potable uses for the Aberjona River watershed aquifers. This approach is not consistent with the use and value determination made by the state. The BHHRA shall be revised to include an evaluation of the potential for potable water use in the Aberjona River watershed aquifer, using data from monitoring wells in this watershed not just the data from the existing private wells.

Olin Response to Specific Comment 3

Please see response to General Comment 1 above. The 2010 value and use determination rests on the observation that a portion of the Site is GW-1 (the Ipswich aquifer Zone II) and that there are private drinking water wells near the Site. The potability of the Aberjona aquifer is not a factor in this determination, precisely because the portion of the aquifer that is within the Site is a low yield aquifer and is not a GW-1 area.

EPA response to Olin Response to Specific Comment 3

Olin has included the requested evaluation of groundwater within the Aberjona watershed as a potential future potable source in the Revised Draft BHHRA, dated December 2018. EPA concurs with this evaluation.

4. Page 1-14 of the report states that: "The Mass DEP document recommends that the risk assessment of the site area groundwater should include active and potential drinking water, vapor seepage into buildings, use of water in industrial processes, excavation into groundwater (worker exposure) and discharge to surface water. The BHHRA is including active and potential drinking water as well as vapor intrusion, use of groundwater for non-potable use (irrigation), and the RI/FS for OU1 and OU2

address the risk to surface water associated with groundwater/surface water interaction." The last sentence in this statement shall be deleted as the BHHRA and RI/FS for OU1 and OU2 fail to correctly assess these exposure scenarios. In addition, the revised RI Report and BHHRA shall be revised to include a correct risk assessment for potable use of groundwater in the Aberjona Watershed as directed in the comment above; for possible vapor seepage into current and future buildings; for worker exposure to groundwater used for industrial processes, for use of groundwater for irrigation, for exposure to groundwater during excavation and for exposure to surface water and sediments in the brook.

Olin Response to Specific Comment 4

This response addresses each of the suggested exposure scenarios as they are presented in the comment:

- The Revised Draft OU3 BHHRA evaluates potential future potable use of the Aberjona watershed as the RME scenario for this exposure point. The evaluation of groundwater in the Aberjona aquifer for potable use has been addressed in General Comment 1 and Specific Comment 3 above.
- "Vapor seepage" was evaluated in the vapor intrusion evaluation that was presented as an appendix to the RI Report. The text of the Revised Draft BHHRA includes a summary of that evaluation, including a statement that no current complete VI pathways were identified, engineering controls for vapor intrusion are recommended for future building construction in the Plant B area and in the Containment Area, and therefore risk calculations were not necessary for this pathway.
- With respect to "groundwater used for industrial processes," there are no current known uses of groundwater within the study area for industrial purposes, and industrial properties in the area are served by public water. As such, this pathway is considered incomplete and has not been evaluated.
- Use of groundwater for irrigation was evaluated in the Draft and Revised Draft BHHRA for applicable exposure points, which are non-potable private wells. Irrigation exposure was not evaluated for private potable wells.
- Construction worker exposure to groundwater and volatiles released from groundwater during excavation was evaluated for the Plant B area, on-, and off-Property in the Draft and Revised Draft BHHRA.
- Human exposure to all identified surface water exposure points, including sediment and surface water in the South Ditch, was evaluated in the BHHRA for OU1/OU2.

EPA response to Olin Response to Specific Comment 4

The EPA response to each bullet in Olin's response is provided below:

- With regard to evaluation of groundwater in the Aberjona aquifer for potable use, see EPA's response to Olin's response to EPA General Comment 1 and Specific Comment 3.
- With regard to "vapor seepage" EPA agrees that no current complete VI pathways were identified and that risk calculations therefore are unnecessary; however, EPA asserts that future VI exposure above EPA risk limits is possible in the absence of institutional controls that require engineering controls for future building construction, and EPA's position must be added to the document.

- With regard to "groundwater used for industrial processes", EPA agrees that there are no known current uses of groundwater for industrial purposes within the study area and that risk calculations for incomplete pathways are unnecessary; however, EPA asserts that the absence of risk calculations for future hypothetical industrial groundwater use and the absence of institutional controls that prevent industrial groundwater use indicates that unacceptable future risk is possible. EPA's position must be added to the document.
- With regard to use of groundwater for irrigation, EPA concurs with the Olin response.
- With regard to construction worker exposure, EPA concurs with Olin response.
- With regard to human exposure to surface water exposure points, EPA agrees that this was evaluated in the BRRHA for OU1 and OU2. EPA requested elimination of the last sentence because it was unclear if the Mass DEP comment about "risk to surface water associated with groundwater/surface water interaction" referred to human health risk or ecological risk. With regard to ecological risk, see EPA's response to Olin's response to EPA specific comment 2 above.

5. Section 1.5.6.2, Page 1-20 – The BHHRA has eliminated off-property vapor intrusion as a pathway of concern because the only exceedances of VISLs were CVOCs considered not Site-related and petroleum-related chemicals that are either "low" or can be attributed to off-property sources. The BHHRA shall document these non-Site-related, "low," and off-property sources.

Olin Response to Specific Comment 5

The text of the Revised Draft BHHRA includes a detailed discussion of non-Site related and off-property sources of CVOCs and petroleum-related constituents with respect to off-property vapor intrusion.

EPA response to Olin Response to Specific Comment 5

EPA concurs with the response.

6. Section 1.5.6.2, Page 1-20 – As requested by EPA, the BHHRA includes a potential drinking water scenario using data collected from DAPL. However, the document repeatedly argues that this is an improbable scenario because the DAPL is so badly contaminated that no one would use it as a drinking water source (it is green/black in color…). All reference to how improbable the scenario is shall be deleted from the BHHRA.

Olin Response to Specific Comment 6

The DAPL scenario has been characterized as a "hypothetical" scenario throughout the Revised Draft BHHRA text. The long-term potable use of DAPL can be considered improbable and, respectfully, has been described as such in the text.

EPA response to Olin Response to Specific Comment 6

Although Olin has included evaluation of risk due to drinking water exposure to DAPL, Olin does not agree with our comment to remove all reference to how improbable this scenario is and does not provide new data or information to support their position. EPA does not agree with Olin's position, and EPA's position must be added to the document.

7. Section 2 - Groundwater data used in BHHRA calculations includes sampling data between 1995 and present. In general, EPA guidance recommends using data from the most recent sampling. The goal is to have at least 10 results to calculate statistically valid 95% UCLs using ProUCL. Data should be limited to more recent data where possible. Monitoring well data included data collected between 2010 and 2017. Many of those wells were sampled most recently during the comprehensive 2010 RI monitoring rounds. However, some wells (for example GW-24, which appears to have been sampled 18 times between 2010 and 2017) have been sampled multiple times. For such monitoring wells, the most recent 1 to 2 rounds of data shall be used unless older rounds are being included to capture the most recent analysis of particular COCs. Private well data included data collected between 1995 and 2017. There are quarterly data going back many years. Data from the last 2-3 years only shall be used to represent current conditions. Town well data included data collected in 2003 and earlier. Because there is no more recent data, the use of this older data from the town wells for COPC selection purposes is acceptable. Data from the former Sanmina property were collected in 1997 through 2004. Because there is no more recent data, the use of older data from the Sanmina wells is acceptable; however, limit that data to the two most recent years (2003 and 2004).

Olin Response to Specific Comment 7

In the Revised Draft BHHRA, COPC selection and EPC calculations are based on data sets consistent with the comment, as follows:

- Private wells: the most recent three years of data, including the most recent validated data (September 2015- June 2018), have been used.
- Sanmina wells (B-1 and B-3): data from 2003-2004 have been used.
- Town Wells: no change.
- Cores of the Ipswich and Aberjona plumes: the two most recent rounds of data for wells in the cores of the plumes where a full suite of RI data analysis (or closest to a full suite of RI analysis) was performed have been used.
- Shallow overburden: the most recent two rounds of data for each shallow overburden well where a full suite of data analysis (or closest to a full suite of analysis) was performed have been used.

EPA response to Olin Response to Specific Comment 7

EPA concurs with the Olin response.

8. Section 2.3, Page 2-17 – The BHHRA assumed that detections of hexavalent chromium in groundwater were false positives. Therefore, the RSL for chromium was used to evaluate total chromium analytical data. Hexavalent chromium was detected in some shallow overburden wells off-property and consistently detected in bedrock in the southwest portion of the Site and therefore shall not be eliminated from consideration in the risk assessment. The BHHRA shall be revised accordingly.

Olin Response to Specific Comment 8

The Revised Draft BHHRA evaluates hexavalent chromium as a COPC where reported as detected. The Revised Draft BHHRA also presents the risk calculations that reflect the position that the detections of hexavalent chromium are false positives. There is discussion of the results for the two scenarios in the text

of the Revised Draft BHHRA (risk characterization and uncertainty analysis). This approach is consistent with the discussion of this issue at the meeting at USEPA on December 10, 2018.

EPA response to Olin Response to Specific Comment 8

EPA concurs with the Olin response.

9. Section 3.2.1, page 3-4 – The BHHRA states that EPCs have been calculated for each of the residential wells where NDMA was detected. There are private wells where NDMA was not detected, but other potentially site related contaminants (chloride, sulfate, nitrogen as ammonia) were. EPA acknowledges that, as discussed in the uncertainty section, there are no currently available EPA tapwater regional screening levels (RSLs) for these contaminants, no applicable toxicity values, and consequently no risks calculated. The BHHRA shall include an explanation (perhaps including this information and referral to the uncertainty section) of why EPCs and risks were not calculated for these private wells.

Olin Response to Specific Comment 9

The EPC and risk characterization sections of the Revised Draft BHHRA text include a discussion of why EPCs and risks were not calculated for wells where NDMA was not detected but where other potentially site-related chemicals have been detected. The primary reason is the absence of published toxicity values for those COPCs.

EPA response to Olin Response to EPA's Specific Comment 9: EPA concurs with the Olin response.

10. Section 3.2.1, pages 3-4 and 3-5 – Groundwater data collected from monitoring wells from the core of the plume(s) were used in calculating EPCs for the Ipswich River watershed and Aberjona River watershed overburden and bedrock. The text indicates locations of selected wells from the core of the Ipswich River watershed are shown on Figures 2.1-1 and 2.1-2. The text indicates locations of selected wells from the core of the Aberjona River watershed are shown on Figures 2.1-4 and 2.1-5. These wells shall be highlighted and encircled on the figures. The BHHRA shall clarify the criterion used to identify which wells were selected as representative of the core of the plumes.
    a. Ipswich River Overburden – GW-84D, GW-85D, GW-86D, and GW-87D
    b. Ipswich River Bedrock – GW-103BR, GW-61BR, GW-62BR, GW-62BRD, GW-62BRDD, GW-62BRDS, and MP-5#03
    c. Aberjona River Overburden – GW-10DR, GW-55D, GW-69D, GW-202D, GW-307, MP-1#07, MP-1#08, MP-1#14, MP-2#06, and MP-2#07
    d. Aberjona River Bedrock – GW-202BRD, GW-202BRS, GW-406BRD, and GW-406BRS

Olin Response to Specific Comment 10

The figures in the Revised Draft BHHRA clearly show the monitoring wells within the cores. In addition, discussion of the criteria used to select those wells included in the cores of the plumes has been added to the text of the Revised Draft BHHRA.

EPA response to Olin Response to Specific Comment 10

EPA agrees that the monitoring wells in the cores are shown; however, the cores themselves must be outlined in the figures.

11. Section 3.2.2, pages 3-5 and 3-6 – Shower EPCs - To calculate inhalation exposures for residential potable water use, the BHHRA is using a showering model (Foster & Chrostowski, 1987) used by MassDEP in developing their MCP-GW-1 standards; rather than using the inhalation of vapors during household water use model (Andelman, 1990) currently used in developing the inhalation portion of the EPA tapwater RSLs. Both models have been used in HHRAs over the last 20+ years. The advantage of the Andelman model is its simplicity, but also that it covers exposures to volatiles from all household water uses (showering and bathing, but also laundry, cooking, dishwashing, etc.). The Foster & Chrostowski model is strictly a model for exposures while showering. By using the Foster & Chrostowski model, the BHHRA does not include a 24 hr./day exposure to household air created by a variety of household water uses, but rather only evaluates inhalation exposures for the few minutes a day while showering. The uncertainty section (Section 6.2.2.1) discusses these two models and the justification for selecting the shower model. The BHHRA shall also present, in the uncertainty section, risks using the Andelman model with an adjusted volatilization constant K at the low end of Andelman's range as a counterpoint to the shower model.

Olin Response to Specific Comment 11

The uncertainly section of the Revised Draft BHHRA text includes a discussion comparing the results of evaluations performed using the Foster & Chrostowski approach and the Andelman approach.

EPA response to Olin Response to EPA's Specific Comment 11: EPA concurs with the Olin response.

12. Section 3.3.1, page 3-8 and Table 3.1-1 - Exposure Assumptions - Because of the selection of the Foster & Chrostowski model, inhalation exposure times are limited to time spent in the bathroom during showering (EPA default showering/bathing time is 43 minutes (0.7 hr.) for adults and 32 minutes (0.54 hr.) for children), as opposed to 24 hr./day exposure to household air. In addition, the BHHRA assumes the shower is only running for 1/2 that time and so uses 1/2 the EPA recommended default showering exposure times within the model to develop the air concentration. Exposure times are still shown on Table 3.1-1 as the default values; however, it is within the calculation of the air concentration that this reduction in time has been carried out ("time in shower" on Table 3.1-1). Although this may be appropriate for a CTE evaluation, the model shall use the full default exposure time to calculate the indoor air EPC while showering for an RME evaluation.

Olin Response to Specific Comment 12

The shower EPC calculations and associated risk calculations in the Revised Draft BHHRA use the full default exposure times for adults and children to calculate the shower air EPCs and associated risks.

EPA response to Olin Response to Specific Comment 12

EPA concurs with the Olin response subject to correction of Table 3.1.1 which still shows time in shower as ½ the default times.

13. Section 5.1.3, page 5-3 - The text states: "Risks at or below 10-4 (upper end of the NCP risk range) do not generally warrant a response action. Risks greater than 10-4 generally warrant development and evaluation of remedial alternatives." (citation omitted). This text shall be replaced with the following statement consistent with EPA policy: "CERCLA requires regulatory risk management review within a targeted cancer risk range of 1E-06 to 1E-04. Risks below 1E-06 (less than 1 in 1 million) are generally considered to be acceptable by EPA. Risks greater than 1E-04 (1 in 10,000) are generally considered to be unacceptable."

Olin Response to Specific Comment 13

The quoted statement was taken directly from "USEPA, 1991. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. April 22, 1991," and is cited as such in the Revised Draft BHHRA text. No change was made with respect to this comment.

EPA response to Olin Response to Specific Comment 13

EPA concurs with the Olin response.

14. Section 5.2.2.6, pages 5-9 and 5-12 – On-property construction workers are exposed to contamination in both groundwater and soils. The BHRRA shall include cumulative risks for construction workers exposed to both these media. Risks for soils were calculated under OU1. Those calculated risks shall be brought forward and the BHRRA shall present total cumulative risks for these receptors.

Olin Response to Specific Comment 14

Risks for construction workers in Table 5.2-1 of the Revised Draft BHHRA include risks calculated in the OU1/OU2 BHHRA for ingestion of soil, dermal contact with soil, and dust inhalation. For on-Property construction workers, risks for groundwater exposure were added to the risks calculated for Exposure Area 1 (on-Property) for 1) surface soil and 2) subsurface soil, separately. For Plant B construction workers, risks for groundwater exposure were added to the risks calculated for Exposure Area 3 (Plant B) for 1) surface soil and 2) subsurface soil, separately. (Risks for surface and subsurface soil were not considered additive in the OU1/OU2 BHHRA.) Off-Property soil is not part of the Site; therefore, no soil risks were added to the risks calculated for a construction worker for off-Property groundwater.

EPA response to Olin Response to Specific Comment 14

EPA concurs with the Olin response.

15. Section 5.2.3.2, pages 5-11 and 5-12 – EPA's current goal for lead evaluations is that no more than 5% of individuals exceed the target blood lead level of 5 µg/dL. The BHHRA shall provide the percent of exposed children with estimated blood lead levels exceeding the target level of 5 µg/dL.

Olin Response to Specific Comment 15

Per text from USEPA's current website (https://www.epa.gov/superfund/lead-superfund-sites) as cited in the Draft OU3 BHHRA, "EPA response actions seek to limit the risk that children will have lead concentrations above 10 µg Pb/dL." Therefore, the text of the Revised Draft BHHRA includes the percent of exposed children with an estimated blood lead level exceeding the target level of 10 µg/dL.

EPA response to Olin Response to Specific Comment 15

EPA does not agree with Olin's position, and EPA's position must be added to the document. EPA's position is that blood lead modeling associated with ingestion of DAPL with a target BLL of 5 ug/dL in no more than 5% of the population must be conducted due to updated scientific considerations which have not appeared yet on the EPA website. EPA's 2016 OLEM memorandum "Updated Scientific Considerations for Lead in Soil Cleanups" (OLEM Directive 9200.2-167) indicates that there is sufficient evidence that adverse health effects are associated with blood lead levels (BLLs) less than 10 ug/dL. The memo mentioned that several studies have observed "clear evidence of cognitive function decrements in young children with mean or group BLLs between 2 and 8 ug/dL." Although this guidance is directed to soil lead cleanup, these scientific findings are applicable to lead in any other ingested media, indicating that risk management decisions made on the basis of a previous target BLL of 10 ug/dL may not be protective.

APPENDIX 6

EPA Comments on Draft Operable Unit 1 & Operable Unit 2 Feasibility Study (March 30, 2018) Olin Chemical Superfund Site, Wilmington, Massachusetts

GENERAL COMMENTS

1. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), Olin was directed not to separate the FS report by OUs. EPA's letter stated: "Consistent with EPA Guidance for conducting Feasibility Studies, the FS for OU1, OU2 and OU3 due to EPA on March 31, 2018 shall be structured with source control alternatives addressing all sources of contamination and groundwater response alternatives. The source control alternatives shall address the Containment Area and DAPL as ongoing sources. The groundwater response alternatives shall address restoration of the aquifer and management of migration. The 2018 FS shall not be divided by OUs, but shall address source control actions and groundwater response actions separately for the entire Site." The March 30, 2018 drafts of the OU1/OU2 and OU3 FS reports have failed to meet these requirements; therefore, these submissions do not comply with EPA Guidance. As noted in EPA's comments on the Draft OU3 RI Report, there is sufficient data to demonstrate that the Site contains significant uncontrolled sources in all of the operable units ("OUs"). OU1 (the Olin Property) contains ongoing sources including but not limited to the material in the Containment Area. OU2 (off-property sediment and surface water) also has ongoing sources of groundwater contamination that have yet to be controlled. OU3 (the groundwater) has DAPL (both on and off property) acting as an ongoing source of contamination to the rest of the aquifer, and contaminated groundwater that continues to migrate. However, there is insufficient data to develop a complete conceptual site model for the bedrock and to evaluate alternatives that restore the aquifer to its beneficial use. Therefore, Olin shall develop a FS focused to clearly identify and evaluate source control alternatives for all OUs in accordance with EPA guidance (in one FS report, not three separate ones) ("Source Control FS"). These alternatives shall include alternatives that remove DAPL from all DAPL pools, that consider in-situ treatment technologies to reduce these sources, that include groundwater response alternatives such as extraction and treatment to contain the overburden and shallow bedrock contamination, and that utilize slurry walls and capping options to contain the sources. Since there is insufficient information to support the development of a FS with a full range of groundwater response alternatives that restore the aquifer, EPA will develop a schedule for the submission of a Further Groundwater Response Action FS Report ("Further Groundwater FS Report") after sufficient data has been collected.

Olin Response to Comment 1

Olin has agreed to develop an Interim Action Feasibility Study (IAFS) that will develop robust alternatives for sources of contamination at the Site (DAPL) as well as higher concentrations of impacts in downgradient groundwater. The IAFS will be developed ahead of (or parallel to) the revised groundwater RI. An OU1, OU2 and OU3 Further Groundwater FS will developed at a later date once data gaps are closed and USEPA and Olin more closely agree to the CSM.

EPA Response

EPA notes that Olin has agreed to develop the IAFS in parallel with its development of the revised OU3 RI (See EPA response to Olin response to comment nos. 1 and 11 for Appendix 1). It is EPA's understanding based on recent discussions with Olin that the IAFS will address sources of contamination in not only OU3 but in all OUs (OUs 1, 2 and 3). Olin shall contact EPA right away if that understanding is incorrect.

2. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), Olin was directed to provide a more robust analysis regarding the applicability of RCRA Subtitle C requirements for the Containment Area under CERCLA. Olin added a brief discussion of past abatement measures within the Containment Area to the FS reports; however, what has been provided is inadequate. Olin shall submit a Source Control FS Report which includes the following:

   - A more detailed discussion of the soils/contaminants that were historically removed from the Containment Area. This discussion should include how the materials were characterized (some as hazardous and some as non-hazardous), a description of why the hazardous wastes were characterized as hazardous, and a description of the sampling methods used to demonstrate compliance with the MCP soil objectives;
   - A summary of the data collected concerning all materials (soils at depth and DAPL) that remain within the Containment Area;
   - A discussion of whether TCLP testing was ever performed on the materials, and if not, an explanation of whether the available data demonstrates one way or another that the materials are hazardous under RCRA;
   - A discussion on whether and where RCRA hazardous wastes were disposed of at the Site on or after November 19, 1980;
   - A discussion of whether the facility ever operated under a RCRA hazardous waste permit; and
   - A discussion of whether the DAPL pumped from the pilot program is manifested and disposed of as hazardous waste.

   Based on this analysis, the Source Control FS Report shall contain a detailed discussion on whether and to what extent the RCRA Subtitle C requirements are either applicable or relevant and appropriate for the Containment Area. If the requirements are either applicable or relevant and appropriate, then, assuming that the alternative will not result in clean closure of the Containment Area, some of the proposed cap designs (pavement and Subtitle D cap) would not meet ARARs and shall be screened out of further analysis. Olin may also propose alternatives in which RCRA hazardous wastes in the Containment Area are removed (or treated) and couple that option with alternate cap designs.

Olin Response to Comment 2

A revised discussion about Containment Area and the suitability of the Property for industrial/commercial use will be provided in the IAFS.

While EPA has placed emphasis on Subtitle C, Olin notes that based on shallow groundwater data and lack of a direct contact exposure risk to soils under the temporary cap Olin does not believe there is a compelling case for a remedial action such as excavation of soils within the Containment Area and requests additional discussion on this issue. Olin notes that the water table elevation in the Containment Area is shallow with a limited vadose zone where leaching would or could occur. Shallow groundwater data within and outside of the Containment Area do not indicate that shallow groundwater inside, and that could flow out through the equalization window is impacted above RSLs, MCLs, or risk based concentrations for COPCs that are risk contributors in groundwater. NDMA is associated with DAPL and diffuse groundwater, not shallow groundwater. While USEPA has insisted the FS must address soils in the Containment Area, it has not made a case as to why.

EPA Response

EPA disagrees with Olin's response and reiterates its comment, including that Olin shall include the analysis described in the original comment. This analysis is required for at least two reasons: 1) the administrative record must contain information on the nature of the material that remains at the site and 2) the information is needed to support the ARARs analysis in the feasibility study. Specifically, based on this analysis, the IAFS shall include a detailed discussion of whether and to what extent the RCRA Subtitle C requirements are either applicable or relevant and appropriate for the Containment Area. EPA notes that certain of Olin's assertions in this response may pertain to the analysis of whether RCRA Subtitle C requirements are relevant and appropriate. Note the EPA has not currently concluded that the Containment Area soils should be classified as RCRA hazardous waste. That's one of the things Olin needs to evaluate. Also, the portion of Olin's response regarding the suitability of the Property for industrial/commercial use is not responsive to EPA's comment.

It's also important to note that the soils in the Containment Area were not adequately characterized during the RI field work. EPA requested full characterization, but Olin declined, citing that such a field effort would damage the temporary cap. Instead, Olin collected surficial soil samples with a hand tool through slices in the temporary cap. The results from these samples appear consistent with a support layer for the temporary cap and were not representative of the deeper materials below. Some historic data was provided by Olin, and this data confirms the presence of COPCs in this area. However, since details on the sampling location were not provided, the nature and extent of contamination remaining in the containment area is not understood as presented. If sufficient data is not available from historical data to determine the nature of the materials present, then this data gap may need to be filled. Finally, as noted in previous responses, EPA believes there are several lines of evidence to demonstrate that the current source control measures may not be adequate and that additional measures must be evaluated as part of the IAFS.

3. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), Olin was directed to remove all statements from the FS report implying that EPA's approval of the OU1/OU2 RI Report constitutes the selection of a presumptive remedy for the Containment Area. Olin has failed to make these required changes. As stated previously by EPA, the selection of a presumptive remedy is not consistent with CERCLA and the NCP, and EPA's approval of the RI was not intended to circumvent the FS process required by the NCP. To comply with NCP, the FS shall look at an appropriate range of alternatives for the Containment Area including no action, excavation and off-site disposal, ex-situ treatment, in-situ treatment, and capping. Furthermore,

ARARs for these alternatives must be identified and factored into the analysis appropriately as noted in General Comment 2, above. In the Source Control FS Report, Olin shall not have any statements implying the selection of a presumptive remedy for the Containment Area, and Olin shall evaluate an appropriate range of alternatives.

Olin Response to Comment 3

Olin agrees to evaluate other alternatives for the Containment Area in a future addenda to the IAFS, such as excavation and off-site disposal once CSM issues are clarified.

That IAFS will include revised text for the evaluation of the capping alternatives, including additional rationale regarding the alternatives' compliance with ARARs.

Olin notes soils at depth in the Containment Area are not an exposure pathway. Water quality of shallow groundwater within the Containment Area will be further discussed. Shallow groundwater quality within and outside the Containment Area near the equalization window are similar and do not indicate flux out of the equalization window is contaminating groundwater outside. If there is no demonstrable impact from shallow soils inside the Containment Area, then there is no basis to require a source removal action as asserted by USEPA.

EPA Response

EPA does not agree with Olin's response to EPA's comment. Sufficient data has not been provided in the RI Report to demonstrate that the material remaining in the containment area does not pose a threat either through leaching or through direct contact. Alternatives that involve removal of the material as well as capping of the material shall be evaluated as part of the IAFS and not delayed to a future addendum. In addition, if the material is to remain in place, then sufficient data must be provided to determine the nature of the cap needed to comply with ARARs. The groundwater results discussed above are not sufficient to demonstrate that the material remaining in this area is not a source material and does not present a risk to human health. Furthermore, the groundwater results presented above is not sufficient to demonstrate which kind of cap is needed to comply with ARARs. As noted above, the soils in the Containment Area are source materials and shall be evaluated as such in the IAFS. See also EPA Response to the Olin Response to Comment #2.

4. The Draft OU1/OU2 FS Report states that "The human health risk assessment indicates the Property overall is suitable for industrial/commercial use." As stated in EPA's December 7, 2017 Comment Letter, "It is not clear if this statement is true for the Containment Area as the OU1/OU2 FS does not include a robust discussion of the data available for soils collected at various depths within the Containment Area. Sampling of this area was limited by the existing cap to shallow samples. This sampling may not be sufficient to allow industrial/commercial use without further response actions such as removal or a cap. In addition, depending on the final remedy selected for the Containment Area, a land use control requiring EPA approval of any use to ensure such uses do not interfere with the remedy selected may be required." Olin's updated Draft OU1/OU2 FS Report failed to address this comment. Olin shall revise the discussion of contaminants within the Containment Area as described in General Comment 2, above, and revise the discussion of the suitability of the Property for industrial/commercial use as noted by EPA.

Olin Response to Comment 4

A revised discussion about Containment Area and the suitability of the Property for industrial/commercial use will be provided in the IAFS. Olin requests additional discussion with USEPA as it does not agree that actions for soil within the Containment Area are warranted. Olin agrees to evaluate other alternatives for the Containment Area in the IAFS such as excavation and off-site disposal, if a consensus on a revised CSM warrants.

EPA Response

EPA understands from discussions with Olin that Olin will evaluate a robust range of alternatives for the Containment Area in the IAFS, including removal of the material (soil, DAPL, and highly contaminated groundwater), even though Olin and EPA have not reached agreement upon a revised CSM. EPA notes that Olin submitted a memorandum on November 8, 2018 regarding Containment Area data gaps that EPA has responded to separately. Olin has agreed that the discussions regarding Containment Area data gaps will not affect the time frame for submission of the IAFS. EPA also notes that its General Comment #4 does not state that excavation of Containment Area soil is necessarily required, rather such an alternative simply needs to be evaluated as part of the IAFS.

5. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), Olin was directed to remove claims that an asphalt cap, RCRA Subtitle D cap, and RCRA Subtitle C cap for the Containment Area would be equally protective. Additionally, EPA explained that Olin inappropriately prepared the OU1/OU2 FS with the assumption that the intent of the permanent cap would be the same as the intent of the interim cap; that is, to reduce infiltration by directing precipitation away from the Containment Area rather than minimizing infiltration to the maximum extent possible. If the RCRA Subtitle C requirements are either applicable or relevant and appropriate, then, assuming that the alternative will not result in clean closure of the Containment Area, the intent of the final cap shall be to reduce infiltration to the maximum extent possible, and to prevent contaminated soils and DAPL from coming in contact with groundwater. In this framework, a RCRA C cap is significantly more protective than an asphalt or RCRA D cap. In the Source Control FS Report, Olin shall revise the discussion of the effectiveness of the three proposed cap types accordingly. Additionally, Olin shall provide detailed analysis supporting its rationale for why the remedial alternatives considered in the Source Control FS Report are protective and meet ARARs.

Olin Response to Comment 5

The IAFS will include revised text for the evaluation of the capping alternatives, including additional rationale regarding the alternatives' compliance with ARARs.

A RCRA C cap is intended to be equivalent to the hydraulic performance of a double liner with leak detection to negate build-up of leachate within the containment facility during long term closure. A single composite cap properly constructed (compliant with Subtitle D) affords the same level of hydraulic performance, though not the same level of redundancy. The transmissivity of the cap need only be equivalent to the transmissivity of the entire saturated slurry wall surface area if the equalization window is abandoned in place. Olin does not concur as stated above by USEPA that any cap could prevent contaminated soils and DAPL from coming in contact with groundwater. DAPL is already in contact with

groundwater and shallow groundwater data does not indicate the existence of a leaching concern for vadose soils under the temporary cap.

In addition, please see response to Comment 4 above.

EPA Response

The IAFS shall first demonstrate the nature of the waste present in the containment area and conclude whether the RCRA C regulations are applicable or relevant and appropriate to the waste that remains. If the RCRA C regulations are determined to be applicable, certain alternatives may be screened out as they will not comply with ARARs. If the RCRA C regulations are determined to be relevant, then the appropriateness of various alternative compliance measures will need to be assessed. EPA also notes that Olin is correct in stating that DAPL material is already in contact with groundwater. In addition, existing data indicates that vadose zone soils in this area contain elevated levels of COPCs. As such, alternatives that minimize infiltration into this area shall be evaluated to address both of these issues.

6. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), Olin was directed to expound upon the discussion of the slurry wall and its effectiveness. Olin's updated Draft OU1/OU2 FS Report does not provide adequate discussion of the construction and integrity of the slurry wall. In addition, based on EPA's review of water level and hydraulic head data, EPA has concluded that the slurry wall may not provide adequate containment in this area (see Specific Comment 11, below, for the full discussion). In summary, the data demonstrates that water is flowing in and out of the Containment Area in areas other than the equalization window/key within the wall. There are several factors that are likely the source of migration in and out of the area. First, since the slurry wall was not keyed into bedrock, groundwater and contaminants may migrate out of the area at the base of the wall.

   Second, due to the nature of how this type of wall is constructed, it is possible that the wall itself could have construction defects or voids which may allow water and contaminants to flow in and out of the area. Third, as noted in comments on the Draft OU3 RI Report, EPA has concluded that the bedrock beneath the Containment Area is likely weathered and fractured based on several lines of evidence. Finally, the window/key that was designed into the wall to release hydraulic head pressure, acts as a conduit for groundwater and contaminants to migrate out of this area. These issues create considerable uncertainty with respect to the effectiveness of the slurry wall and interim cap as adequate source control measures for this area of the Site. It is also important to note that the construction of this slurry wall and the interim cap did not receive final approval from MassDEP as they shared the same concerns. Olin shall include in the Source Control FS Report a discussion of these issues and the uncertainty they present. Olin shall also include a discussion of the water level and hydraulic head data as presented by EPA in Specific Comment 11, below, as evidence of the uncertainty that exists. In addition, the Source Control FS Report shall include alternatives that further minimize releases from this area, including alternatives that improves the effectiveness of the current system (slurry wall and cap) and alternatives that remove or treat the remaining source material in this area.

Olin Response to Comment 6

USEPA has presented various lines of evidence to support their assertion that the slurry wall is not effective at containing DAPL and diffuse-layer groundwater from the on-property DAPL pool. Each line of evidence that USEPA has provided is based on nothing more than speculation. As such, Olin cannot accept this conclusion. There is no definitive data that suggests the slurry wall is ineffective for its intended purpose. The only technical analysis by USEPA to date that Olin is aware of has been to compare water levels along the northern and southern side of the interior of the Containment Area. USEPA failed to acknowledge the presence of a groundwater mound from the equalization window and from infiltration through the temporary cap. The slight gradient that is apparent, when these other water levels are omitted, appears to have little significance as an indication of slurry wall performance. USEPA asserts that the wall itself may have construction-related defects, but this is complete speculation with no data to support this supposition. It is unclear to Olin why USEPA appears to be determined to declare the wall ineffective. Containment walls have been constructed for years with no automatic questions regarding their effectiveness, and the slurry wall at the Site was constructed using common technologies by a firm that was fully qualified to do so. Additionally, significant testing was conducted to ensure that the materials of construction were appropriate for the small portion of the wall in contact with DAPL.

DAPL has existed inside and outside the slurry wall since it's installation. Given the groundwater flow paths, and the fact that there are DAPL and DAPL-related impacts outside the wall is reason enough to understand concentration dynamics at wells west and south of the wall. Olin has also provided a robust hydrogeologic analysis that clearly indicates the effectiveness of the wall based on gradients both inside and outside the wall. So, Olin firmly believes that the slurry wall continues to be effective for its intended purpose based on construction methods, pre-construction testing, and hydrogeologic data collected to data both inside and outside the wall. However, USEPA and Olin should work to generate the data necessary to render this question clear to all parties (if possible). This issue will be discussed at the upcoming January 2019 meeting.

EPA Response

EPA disagrees with Olin's response and reiterates its original comment. EPA's conclusions are based on factual records regarding the actual construction of the wall, and Site hydraulic and geologic data collected since the wall was constructed. EPA has no bias with regard to the slurry wall, and our objective is to ensure that adequate source control measures are considered based on the available facts and data-set. EPA notes that it has agreed to continue technical discussions with Olin regarding closing data gaps pertaining to the Containment Area, but such discussions shall not impact the timeframe for submission of the IAFS.

7. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), Olin was directed to expand upon the discussion of the health risk from TMP in soils, and to lay out alternatives that prevent vapor intrusion. In the updated Draft OU1/OU2 FS Report, the discussion regarding mitigating the health risk from TMP in soils remains too brief. Olin shall expand upon this discussion so that it can be carried through all alternatives in the FS. Olin shall present and lay out alternatives that prevent vapor intrusion; it is not adequate to make only general statements that VI risk will be addressed if future development occurs in potential VI exposure areas. There must be analysis of alternatives for options that control the potential exposure routes. In the Source Control FS Report, Olin shall present and lay out alternatives that prevent vapor intrusion in areas where it may be a concern (including the Containment Area).

Olin Response to Comment 7

Olin will expand the discussion in the Future FS to better explain that there are no unacceptable risks related to vapor intrusion into existing site buildings due to TMPs in soil. Vapor intrusion will be identified as a potential concern for future buildings that may be constructed in areas where TMPs are present in soil. The revised text will include potential actions that may be implemented to address vapor intrusion in future buildings and how these actions would be implemented. However, the means of mitigating vapor intrusion into future buildings will be dependent upon the location, design, construction, and use of the potential future buildings, which are all unknown at this time. Therefore, including a vapor mitigation system for some number of buildings that may be constructed at some future location(s) and used for some unknown purpose(s) is not appropriate to include in the remedial alternatives to be evaluated in the IAFS.

EPA Response

EPA generally agrees with this response and reiterates its comment that in the IAFS, Olin shall present alternatives that prevent vapor intrusion in areas where it may be a concern (including the Containment Area). The alternatives shall include a range of acceptable potential technologies and methods for mitigation of future buildings.

8. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), EPA directed Olin to modify the Remedial Action Objectives ("RAOs") for OU1 and OU2 in the FS. The revised RAOs remain inadequate, and shall be revised as follows for inclusion in the Source Control FS Report:

    - The RAO for vapor intrusion, in the updated Draft OU1/OU2 FS Report, is stated: "Mitigate potential impacts to public health resulting from soil vapor intrusion into future buildings that may be constructed in BBHRA EA1, EA3, and EA7."

    - This RAO discounts potential vapor intrusion concerns at other areas of the Site, such as the Containment Area. Olin shall revise this RAO to state: "Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the Site."

Olin Response to Comment 8 (above)

Olin will include this RAO as written.

EPA Response

EPA notes Olin's response and has no further comments.

8. Continued

    - The RAO for surface soil and sediment, in the updated Draft OU1/OU2 FS Report, states: "Remediate sediments and surface soil to conditions that mitigate ecological receptor exposure and/or potential adverse population effects associated with chromium and BEHP in

Lower South Ditch sediment and BERA EA5 surface soil at concentrations associated with possible adverse population effects."

- Olin shall revise this RAO to state: "Restore soils and sediments to pre- release/background conditions to the extent feasible, at a minimum to levels that will result in self-sustaining benthic communities with diversity and structure comparable to that in appropriate reference areas."

Olin Response to Comment 8 (continued)

Olin requests further discussion with USEPA on this RAO prior to finalizing the IAFS. As discussed previously, Olin is not aware of pre-release background conditions, or whether there was even a water-containing ditch prior to original Site development. As such, the feasibility of restoration to "pre-release/background" conditions is unclear.

The RAO statement from the OU1/OU2 FS is consistent with the findings of the OU1/OU2 Baseline Ecological Risk Assessment (BERA) and the conclusions of the USEPA-approved RI Report for OU1/OU2.

The proposed RAO language suggests restoration to pre-release/background conditions to the extent feasible. Pre-release/background conditions for sediment in the Lower South Ditch and surface soil in BERA EA-5 adjacent to the Lower South Ditch are unknown. That objective would be unworkable could not be implemented. It is typical to identify the ARAR-based or risk-based objective first and then suggest remediating to background to the extent feasible, not the reverse as is written in the fourth bullet. The ARARs-based and risk-based objectives are primary remedial objectives and restoration to background a secondary one.

The proposed RAO language in the fourth bullet presumes that in the Lower South Ditch there are not self-sustaining benthic communities with diversity and structure comparable to that in appropriate reference areas. The BERA and RI Report did not make that conclusion. The BERA ad RI Report concluded that for specific chemicals of potential concern (BEHP and chromium) detected in sediments various adverse effects to certain ecological receptors are possible. Benthic diversity and structure were not characterized or evaluated for the Lower South Ditch nor for any reference areas appropriate for the Lower South Ditch. Therefore, it is not known what sediment conditions would need to be achieved in order to achieve "self-sustaining benthic communities with diversity and structure comparable to that in appropriate reference areas". The RAO previously written to mitigate the risks to ecological receptors for the chemicals of concern identified by the BERA is appropriate and implementable.

Olin previously proposed to excavate the Lower South Ditch sediments (removing the sediments completely) and the surface soils adjacent to the Lower South Ditch (extent based on ecological risk assessment PRGs for chromium and BEHP in soil). The previously proposed remedial action would be appropriate for mitigating possible adverse effects for ecological receptors and the proposed action is consistent with the RAO proposed in the OU1/OU2 FS.

The BERA concluded for Lower South Ditch sediments: *In the Lower South Ditch, most of the measurement endpoints found that adverse effects could occur for ecological receptor populations and communities exposed to surface water and sediment there. The sediment benchmark comparison found that there could be effects to benthic invertebrate and amphibian communities from chromium and silver; site-*

related risks from the EPH fraction are uncertain. The sediment benchmark comparison carries a low inference weight. The sediment toxicity test, which carries a medium/high inference weight, indicated that the worst-case conditions in the Lower South Ditch adversely affect the benthic community. The marsh wren food chain model, which also carries a medium/high inference weight, suggested that BEHP may pose a risk. Three other food chain models (green heron, muskrat, raccoon), also carrying a medium/high inference weight found that adverse effects from COPECs in Lower South Ditch are unlikely. The overall weight-of-evidence indicates that adverse site-related effects for ecological receptor populations and communities exposed to Lower South Ditch sediment may be possible from BEHP and chromium.

The BERA concluded for EA-5 surface soil: *Most of the measurement endpoints found that adverse effects may be possible for ecological receptor populations and communities exposed to EA-5 soil. Food chain models for robins and shrews, and plant and invertebrate effects benchmark comparisons all indicated that adverse site-related effects may be possible from chromium in EA-5 soil. Adverse effects from BEHP to robins and shrews may also be possible.*

EPA Response

EPA acknowledges Olin's response. There also appears to be no reasonable reference area. Therefore, Olin shall revise this RAO to state: "Restore soils and sediments to levels of Site-related chemicals of concern that do not exceed LOAEL risk-based soil concentrations derived in the BERA, LOEC risk-based sediment concentrations derived in the BERA, and do not exceed 20% effect levels in sediment acute and chronic in situ or laboratory toxicity tests compared to control sediment."

8. Continued

- The RAO for surface water, in the updated Draft OU1/OU2 FS Report, states: "Achieve national Recommended Water Quality Criteria for aquatic life for ammonia and chromium in South Ditch surface water." This RAO discounts other contaminants which may exceed the NRWQC. Olin shall revise this RAO to state: "Restore surface water to national recommended water quality criteria for the contaminants of concern."

Olin Response to Comment 8 (continued): Olin will review the known impacts observed in South Ditch surface water. The RAO will be revised as written, but only to those impacts that exceed the NRWQC and are known to be Site-related.

The RAO "Achieve national Recommended Water Quality Criteria for aquatic life for ammonia and chromium in South Ditch surface water" is appropriate. Ammonia and chromium were identified as chemicals of concern for the surface water of the South Ditch. The South Ditch is a storm water conveyance for the industrial/commercial area surrounding the 51 Eames Street Property. The proposed language to restore water quality to ambient water quality criteria presumes that the water quality entering the South Ditch from the surrounding area previously met and currently meets ambient water quality criteria and the surface water in the South Ditch met ambient water quality criteria at some time in the past. The language that states the RAO is to achieve ambient water quality criteria for chemicals of concern (Site-related), including ammonia and chromium, is appropriate.

EPA Response

EPA acknowledges Olin's response. However, the RAO shall be revised to state: "Restore surface water to achieve the NRWQC for Site-related chemicals of concern (e.g. ammonia, chromium) and eliminate acute and chronic toxicity to aquatic organisms, as measured by in situ or laboratory toxicity tests."

8. Continued

- The RAO for the Containment Area, in the updated Draft OU1/OU2 FS Report, states: "Installation of a permanent cap over the Slurry Wall Containment Area based on the recommendations presented in the Final OU1/OU2 RI Report (AMEC, 2015) approved by the USEPA (USEPA, 2015). The cap would continue to permanently minimize infiltration into the Containment Structure. Installation of a permanent cap is also a binding contractual requirement under the current Purchase and Sale Agreement that exists for sale of the property."

As noted in General Comment 3, above, this statement implies that EPA's approval of the OU1/OU2 RI constitutes the selection of a presumptive remedy for the Containment Area. Consistent with the NCP, a range of alternatives shall be developed and evaluated for the Containment Area in the Source Control FS. This statement shall be removed from the text, and a full range of remedial alternatives shall be evaluated. The existence of a Purchase and Sale Agreement does not supersede the need for a full evaluation of remedial alternatives, nor does it preclude EPA from selecting a remedy that is protective of human health and the environment and achieves ARARs.

Olin Response to Comment 8 (continued)

During development of the OU1/OU2 RI, USEPA directed Olin to include a permanent cap in each alterative that was to be review as part of an OU1/OU2 FS (prior to USEPA combining all OUs). The purpose of this was to honor the existing Purchase and Sale agreement and to guarantee that a permanent cap would be installed. Presumptive remedies are allowed under CERCA, and often preferred, for a variety of reasons (Implementing Presumptive Remedies: Notebook of Guidance and Resource Materials, USEPA, 1997). Use of a preferred remedy that is an obvious choice for an OU1 remedy will also work to facilitate property redevelopment. This can be done consistent with the NCP and USEPA guidance. Olin requests further discussion with USEPA prior to finalizing the IAFS.

EPA Response

EPA disagrees with Olin's response and reiterates its original comment. See also EPA response to Comment 9 below. Under the NCP and CERCLA guidance, presumptive remedies are only applicable to certain categories of sites (i.e. landfills). The circumstances at the Olin site and the presence of a temporary cap do not support a presumptive remedy. Therefore, the IAFS should include and evaluate a range of alternatives including but not limited to capping and excavation of soils. The evaluation of alternatives may demonstrate that excavation may not be practical, however, EPA can't presume that is the case without a detailed analysis. To the extent that Olin requests further clarification from EPA, EPA is willing to have additional discussions.

Olin Response to Comment 8

See responses following each comment related to RAOs above.

See EPA responses above under this Comment.

9. In EPA's December 7, 2017 comments on Olin's Draft Feasibility Study Report for OU1 and OU2 (October 31, 2017), Olin was directed to develop RAOs for soil, including soils in the Containment Area. Olin has failed to provide RAOs for soil in this Report, and shall provide RAOs for soil in the Source Control FS Report. Examples of applicable RAOs for soil include:

    - Prevent direct human contact/ingestion/inhalation with contaminated soils that exceed ARAR and risk-based standards;
    - Prevent soil leaching and resulting contaminant migration to groundwater in excess of leaching-based standards; and
    - Prevent migration of contaminated soil to wetlands and adjoining properties.

Olin Response to Comment 9

The OU1 BHHRA did not identify soil areas with unacceptable human health risk at the former manufacturing facility. On the contrary the BHHRA and the OU1 RI concluded the property was suitable for redevelopment for commercial /industrial purposes. Health risks associated with commercial/industrial worker exposure to surface soil in the containment area was previously evaluated and risk and hazard index met CERCLA limits. The Notice and Declaration of Restrictive Covenant that has been filed with the Registry of Deeds prohibits excavation of any kind (except for grading and shaping necessary to install a permanent cap) in the containment area. Therefore, no human contact with soils within the Containment Area is foreseeable. Soils in the Containment Area do not pose an unacceptable risk for human exposure and based on current groundwater water quality data do not pose a threat by leaching to groundwater. In addition, leaching based standards are extremely conservative (based on use of groundwater as drinking water) and are not an appropriate basis for establishing RAOs for most of the Property. There are no identified areas where soils are eroding and migrating to wetland or adjoin properties, therefore such RAOs are not warranted.

Olin requests further discussion with USEPA relative to RAOs for OU1.

EPA Response

EPA disagrees with Olin's response and reiterates its original comment. EPA believes that the soils within the containment area beneath the cover materials, do pose an unacceptable risk both to possible human exposure and as a possible source of leaching. During the scoping of the BHHRA, EPA did not require Olin to evaluate risks posed by exposure to deeper soils in the containment area because it was assumed that all parties understood that those soils posed an unacceptable risk and would be properly addressed in the FS through the development and evaluation of an appropriate range of response actions. Since this Site does not meet the definition of a site that qualifies for a presumptive remedy, the appropriate range of response actions includes not only capping but also removal. Superfund's RI/FS development and remedy selection do not accept the use of deed notices or declarations of restricted covenants to be used as the sole means to prevent exposure and do not eliminate the need to develop and evaluate an appropriate range of response actions. With respect to leaching, the OU1 OU2 RI Report concluded that the leaching potential of soils would be further evaluated in the OU3 RI. EPA also requested in its comments that additional data (such as TCLP, waste manifests and any other data) be presented by Olin in these documents to demonstrate the leaching potential of the deeper soils within the containment area and to assist with the determination of whether and to what extent the RCRA Subtitle C requirements are

either applicable or relevant and appropriate and accordingly what type of cap would be appropriate, thereby meeting ARARs. The example RAOs in EPA's original comment are still applicable to Site conditions, and Olin is still required to provide RAOs for soils in the IAFS.

In addition, chromium appears to be leaching into South Ditch from the soils in the containment area and ammonia from soils adjacent to the lower South Ditch at concentrations that are likely to be having adverse ecological impacts. Therefore, an additional RAO shall be included as follows, "Prevent leaching of Site-related chemicals of concern into sediment and surface water to levels that exceed NRWQC, LOEC risk-based concentrations in surface water or sediment, or concentrations that have toxicity to aquatic organisms."

10. The updated Draft OU1/OU2 FS Report fails to address an area of PCB-impacted soil located in the former electrical substation area on the northwest portion of the Property identified by Olin during the RI. Olin concluded that the reported concentrations of PCBs do not pose a risk above CERCLA limits for current or future workers. The maximum concentration of PCBs in surface and shallow soils reported during the OU1/OU2 RI is approximately 13 mg/kg. Olin indicated that no further effort is required to address these soils. EPA does not agree with Olin's interpretation.

    In EPA's November 11, 2014 Conditional Approval Letter for the April 10, 2014 Draft Remedial Investigation and Risk Assessment Reports, EPA directed Olin to compile alternatives in the FS to include actions to address the PCBs in soil. Olin failed to respond to this request. Olin shall provide a full range of remedial alternatives which address soils that contain PCBs above 1 mg/kg in the Source Control FS Report.

Olin Response to Comment 10

In the December 10, 2018 meeting USEPA withdrew its concern for the "PCB area." No further response is warranted relative to the referenced area.

EPA Response

EPA notes Olin's response and has no further comment.

11. Throughout this updated Draft OU1/OU2 FS Report, the Draft OU3 RI Report and the Draft OU3 FS Report, there are references to this Site being an MCP site. In some instances, these references imply that the work conducted under the MCP was acceptable or approved by MassDEP. The Site is no longer regulated under the MCP. Since the MassDEP's comments were not being adequately addressed by Olin and MassDEP was not satisfied with the work conducted, MassDEP requested that the Site be listed on the National Priorities List and addressed under CERCLA with EPA oversite. The documents should be corrected to provide an accurate summary of the Site's history. Furthermore, statements that imply work done under the MCP was sufficient shall be deleted.

Olin Response to Comment 11

The statements in Comment 11 are not factual. Brief summary rebuttal statements are identified in the bullets below and the documentation to support the responses are provided below. Statements "that

imply work done under the MCP was sufficient" will not be deleted and factual statements that the work was approved by MassDEP will be retained in these documents.

- The updated Draft OU1/OU2 FS Report, the Draft OU3 RI Report and the DraftOU3 FS Report reported factual information concerning work performed under the MCP and under MassDEP supervision. That work was, in fact, formally approved in writing by MassDEP. The USEPA Settlement Agreement and Order On Consent for the Site states, as a finding of fact, that MassDEP supervised Olin's MCP activities.
- The Site was an MCP Priority Site (starting in 1993) and a Tier IA disposal site starting in 1994 (with all workplans and reports prepared by its consultants and Licensed Site Professionals (LSPs) formally approved or disapproved in writing by MassDEP) under the MCP requirements until suspension of reviews by MassDEP as communicated to Olin in a letter dated December 6, 2005.
- More than 100 work plans, monitoring reports, investigation reports, risk assessments, groundwater modeling reports, and feasibility studies were submitted to and approved by MassDEP during that time period. If MassDEP had not been satisfied with the work conducted and Olin had not been responsive to MassDEP comments (as alleged in the USEPA comment), the work plans, investigation and monitoring activities, and the associated reports would not have been approved by MassDEP.
- During the period from 1993 through 2005, Olin and its consultants and LSPs had a positive working relationship with MassDEP project managers for the Site and virtually all work plans, investigation activities, monitoring activities, mitigation and removal actions, and reports and other submittals to MassDEP were approved (either unconditionally or conditionally) in writing by MassDEP. Olin met requirements associated with conditional approvals of work plans or reports and there was substantial cooperation between Olin, its consultants and LSPs and MassDEP.
- Near the end of the 1993-2005 period of MassDEP supervision of the Site, with the discovery of NDMA in groundwater and in four Town Wells, the suspension of pumping of the Town Wells, the increased complexity of the nature and extent of groundwater contamination, the magnitude and complexity of the Site had grown substantially. The amount of technical resources (at MassDEP and at Olin) that would be required to further investigate groundwater, develop and implement source control strategies, and to develop and implement mitigation and remediation strategies was also growing substantially. It was also becoming apparent that the presence of NDMA in groundwater and the suspension of operation of the Town Wells were conditions that could clearly contribute to a CERCLA HRS score that would be above the threshold for listing the Site on the USEPA National Priorities List (NPL). MassDEP may have been seeking a way to accelerate the schedule for designing and initiating a Pilot Study for DAPL extraction. These factors are a more accurate explanation for MassDEP's request for USEPA to place the Site on the NPL than the allegations made in the USEPA comment above.

The information provided below is intended to provide documentation of the bulleted rebuttal statements above.

The Site was an MCP Priority Site and a Tier IA disposal site (with all workplans and reports formally approved or disapproved in writing by MassDEP) under the MCP from 1993 until suspension of reviews by MassDEP as communicated to Olin in a letter dated December 6, 2005. The suspension of reviews by MassDEP took place after it was clear to all parties that the Site would be listed on the NPL and USEPA would become the lead agency.

Between 1993 and the end of 2005 the MassDEP was the final decision-maker (approval/disapproval of all regulatory submittals) for the 51 Eames Street MCP Site (RTN 3-0471). Even with the establishment of the Licensed Site Professionals (LSP) Program, a subset of disposal sites (the disposal sites classified as Tier IA sites) was still under direct supervision of the MassDEP. The 51 Eames Street Site was a Tier IA Site, and all submittals were reviewed and approved or disapproved by MassDEP.

Submittals made by Site LSPs to and reviewed by MassDEP included investigation work plans, well installation work plans, multi-level piezometer installation work plans, several field and laboratory DAPL investigations and studies, soil investigation work plans, seismic refraction survey work plans, Release Abatement Measure plans and associated status reports and completion reports, risk assessment scopes of work, imminent hazard evaluations, Immediate Response Action plans, substantial hazard evaluations, Town & Sentinel Well monitoring program reports, and post-construction groundwater and surface water quarterly monitoring reports. Calcium Sulfate landfill groundwater monitoring reports were also submitted to MassDEP.

Release Abatement Measures approved by Mass DEP included excavation of waste and impacted soils down to the bedrock surface in the area of the former Lake Poly, excavation and disposal of drums and buried debris from the area south of the warehouses (containment area), excavation and disposal of sediment from the former Central Pond, the on-Property West Ditch, the West Ditch Wetland, and the Upper South Ditch, the construction of the weir structure in the Upper South Ditch, construction of the slurry wall containment area, associated storm water retention pond, and the temporary cap, installation, operation, and reporting for an air sparge/soil vapor extraction to remove TMPS from the subsurface in the area west of the current Plant B treatment building, and operation and monitoring of the Plant B groundwater extraction and treatment system that was designed to prevent migration of LNAPL to the west ditch. The NDMA Precursor Test was conducted consistent with a workplan approved by MassDEP. A so-called Super sampling event was conducted at MassDEP's request that included sample analysis for a very comprehensive, expanded list of analytes in monitoring wells, Town Wells, and the Town Drinking Water distribution system. All of these activities and submittals during the 1993 through 2005 were reviewed and approved by MassDEP. Please find attached **Table 1**, which provides examples of the MassDEP written communications to Olin and Olin LSPs that document the ongoing supervision and approval of the work that was conducted under the MCP requirements. **Table 1** includes approximately 90 communications from MassDEP.

Further corroboration of the information above, and more specifically, of the supervision of Olin's activities by MassDEP, is provided in item 18. of Section V. Findings of Fact of the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION I, ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY for the Olin Chemical Superfund Site Wilmington, Middlesex County, Massachusetts dated 6/28/2007. Item 18. from this Administrative Settlement Agreement and order On Consent is reproduced below.

18. The Site has been subjected to many years of investigations and cleanups carried out by Olin and supervised by MassDEP under Chapter 21E of the General Laws of Massachusetts and the Massachusetts Contingency Plan ("MCP"). The Site has been a "Priority" site under the MCP since 1993, and a "Tier I" site since 1994. In addition to other investigations and cleanups, Olin has completed a Phase II Field Investigation Report and several investigatory supplements (including a study of the Maple Meadow Brook Aquifer), removed buried drums, excavated soils and

sediments, constructed and operated a groundwater pump-and-treat system, built a subsurface containment system (including a slurry wall and a temporary cap) around the contaminated groundwater on the Olin Property, and installed a network of wells monitoring groundwater on and off the Olin Property. Olin has recently sought MassDEP's approval under state solid waste regulations to close the Calcium Sulfate Landfill, which is located on the southern portion of the Olin Property.

Also, please find attached, to document the nature of MassDEP review and approval of MCP submittals, the MassDEP Conditional Approval Letter of the 1997 Olin Chemical, 51 Eames Street, Wilmington, MA, RTN: 3-0471, Supplemental Phase II Report (Comprehensive Seven Volume Report – Multi-media nature and extent, fate & transport, human health and ecological risk assessment, groundwater modeling).

EPA Response

EPA acknowledges Olin's detailed response to this comment. Olin can include this detail in the revised documents if it would like. However, it's important to note that MassDEP's previous approvals of any past document or work have no bearing on the adequacy of the documents and work under CERCLA. In other words, Olin shall not use previous approvals by MassDEP as a basis for not fully addressing an EPA comment. It is also important to note that MassDEP continues to provide written comments on Olin's deliverables and these current comment letters best represent MassDEP's current position on the work conducted and the conclusions presented.

SPECIFIC COMMENTS

1. Page ES-1 – Olin states: "Based on the conclusions of the OU1/OU2, RI report, this OU1/OU2 FS develops and evaluates remedial alternatives to address the following…Installation of a permanent cap over the OU1 Slurry Wall Containment Area." As addressed in General Comment 3, above, this statement implies that EPA's approval of the OU1/OU2 RI constitutes the selection of a remedy in the Containment Area. This statement shall be removed and a full range of remedial alternatives shall be evaluated for the Containment Area.

Olin Response to Comment 1

The USEPA approved the OU1/OU2 RI Report, which included a recommendation to install a permanent cap to replace the temporary cap previously installed. Therefore, it is Olin's position that the USEPA approval of the RI Report constitutes agreement with providing a permanent cover over the Containment Area.

Olin disagrees that other alternatives for the Containment Area in the Source Control FS are warranted, such as excavation and off-site disposal. However, as stated in Response to General Comment #1, Olin will proceed with development of an IAFS that will provide an evaluation of alternatives for source (DAPL) control and prevention of migration for higher concentrations of impacts in downgradient groundwater.

EPA Response

EPA disagrees with Olin's response and reiterates its original comment. EPA understands from discussions with Olin that Olin will evaluate a robust range of alternatives for the Containment Area in the IAFS even though Olin and EPA have not reached agreement upon a revised CSM

2. Page ES-1 – For required revisions to the RAOs, see General Comments 8 and 9, above.

Olin Response to Comment 2

The Executive Summary will be revised to be consistent with the revised RAOs, once they are agreed upon between Olin and the USEPA.

EPA Response

Please see EPA's response to Olin's Response to General Comment #8 above.

3. Page 1-1, Section 1.0 – Olin states: "This revised OU1 & OU2 FS addresses groundwater interaction between OU3 and OU1/OU2." As noted throughout this comment letter, Olin has failed to adequately address the interaction of contaminated groundwater, surface water, and sediment. Olin shall submit a Source Control FS Report (as described in General Comment 1, above) which provides a more complete analysis in accordance with the comments provided.

Olin Response to Comment 3

Olin agrees to prepare an IAFS with additional analysis. It is Olin's position that groundwater affects surface water only, and does not constitute a source to the un-remediated sediment and soil along lower South Ditch.

EPA Response

EPA reiterates its comment that the IAFS shall provide a complete analysis of the interaction between contaminated groundwater, surface water, and sediment. Groundwater serves as a source to un-remediated sediment because the sediment retains site-related chemicals as shown by the accumulation of chromium and BEHP in the remediated sediments, before they were excavated, as well as the high level of ammonia in surface water, which can only come from groundwater via passage through sediment.

4. Page 1-4, Section 1.3 – In discussing the RAM for Former Drum Areas A and B, Olin states: "Twenty-nine of the 163 drums were characterized as hazardous waste and were shipped off- site for disposal at a permitted hazardous waste facility." As discussed in General Comment 2, above, Olin shall provide additional details about these wastes (i.e., why they were characterized as hazardous) and the implications for what other hazardous wastes may remain in the Containment Area.

Olin Response to Comment 4

The IAFS will to the extent possible include revised text to more thoroughly describe the materials within the Containment Area and the associated implication for any hazardous wastes that may remain within

the Containment Area. USEPA has asserted that soil within the Containment Area require further action but has not provided a basis for its position. Olin does not believe additional actions are required for soils at the Containment Area.

The Notice and Declaration of Restrictive Covenant filed with the Registry of Deeds prohibits excavation in the Containment Area except for shaping and grading to install a permanent cap. This eliminates future construction worker exposure and any human direct contact exposure to subsurface soil in the Containment Area. The BHHRA evaluated Trespasser exposures for surface soil in the Containment Area. The BHHRA did not identify any carcinogenic risks associated with those areas that were above the CERCLA acceptable risk range of 10^{-6} to 10^{-4} or a non-cancer Hazard Index of 1.

EPA Response

EPA does not agree with Olin's response. See EPA response to Olin Responses to General Comments #2, #4 and #9.

5. Page 1-5, Section 1.3, bullet 4: Olin has not provided sufficient data to support the claim made here regarding vertical hydraulic gradients within the Containment Area. EPA is aware of only one set of paired deep/shallow water levels measured in 2016 (which was not included in the Draft OU3 RI Report). Olin shall provide additional data to substantiate this claim.

Olin Response to Comment 5

All available information will be presented as requested. Olin and USEPA are engaged in discussion of data gaps for the Containment Area. The IAFS will incorporate any additional data collected.

EPA Response

EPA notes Olin's response and has no further comment.

6. Page 1-5, Section 1.3: Olin states that the Calcium Sulfate Landfill (CSL) is in the 25^{th} year of a 30-year post-closure monitoring period. Section 2.1.2.7 of the Draft OU3 RI Report states that it is in the 30^{th} year. Olin shall correct whichever of these statements is made in error.

Olin Response to Comment 6

The text of the IAFS will identify that 2018 is the 30^{th} year of the CSL post-closure monitoring period.

EPA Response

EPA notes Olin's response and has no further comment.

7. Page 1-6, Section 1.3 – Olin shall provide a reference to a figure to show the Site surface water bodies.

Olin Response to Comment 7

The discussion regarding surface water bodies in Section 1.3 will be revised for the IAFS to include a reference to Figures 1.2-2 and 1.3-1 for the locations of the surface water bodies associated with OU1 and OU2.

EPA Response

EPA notes Olin's response and has no further comment.

8. Sections 1.4 and 1.5 – Olin shall submit a Source Control FS Report that includes a detailed discussion of the interaction of groundwater with surface water and sediments. The discussion shall include an analysis of the impacts this interaction has on contaminant fate and transport.

Olin Response to Comment 8

As stated in Response to General Comment #1, Olin will proceed with development of a IAFS that includes a detailed discussion of the interaction of groundwater with surface water and sediments. Note this discussion will be limited to South Ditch based on the results of the OU1 OU2 RI.

EPA Response

EPA agrees with Olin's response, except that the discussion of the interaction of groundwater with surface water and sediments in the IAFS shall not be limited to the South Ditch, but should also include the East Ditch.

9. Page 1-7, Section 1.4.1 – Olin shall include a reference to a figure in the FS depicting TMPs below 10 feet bgs.

Olin Response to Comment 9

Figure 4.1-13 from the Final OU1/OU2 RI Report will be included in the IAFS to show TMP concentrations in soil at depths greater than 10 feet, and a reference to this new figure will be added to Section 1.4.1.

EPA Response

EPA notes Olin's response and has no further comment.

10. Page 1-5, Section 1.3 – Olin states: "The OCSS also contains a Slurry Wall/Containment Structure that was constructed in 2000/2001 as a RAM approved by MassDEP while the OCSS was regulated under the MCP. The location of the Slurry Wall/Containment Structure is shown on **Figure 1.3-1**. The purpose of the Slurry Wall/Containment Structure was to achieve a permanent source control measure for the on-Property DAPL Pool, consistent with requirements of the MCP. The objective of this source control action was to eliminate, to the extent feasible, the on- Property DAPL source material as a source of dissolved constituents to groundwater." MassDEP notes that the slurry wall /

Containment Area was only conditionally approved. MassDEP also notes that a reason for transferring the Site to USEPA was because conditions that were stated in the "conditional approval" letter were not being met. Olin shall revise accordingly.

Olin Response to Comment 10

The MassDEP, in a letter of March 29, 2005, fully approved the *Part 2 Construction RAM Status Report No. 8 (*submitted to MassDEP on September 7, 2004 and *the Completion Report and Addendum to Status Report No. 8 submitted on October 4, 2004*. The MassDEP letter is attached to this RTC package. This letter does not contain any reference to "conditional approval" of the RAM which included the installation of the slurry wall and the temporary cap. The statement that "MassDEP also notes that a reason for transferring the Site to USEPA was because conditions that were stated in the "conditional approval" letter were not being met" seems irrelevant to the technical issues at hand, we have no record of MassDEP making such a statement in the 2005 timeframe, and both of the "additional activities" recommended in the MassDEP approval Letter have been addressed by Olin (additional delineation and removal of Kempore for the Lake Poly area and the evaluation, design, and implementation of the DAPL pilot extraction test.

The Construction RAM (Release Abatement Measure) was conducted to prepare the property for redevelopment (anticipated future construction of a Warehousing Facility) included several measures including 1) sediment excavation and restoration from the west dich wetland, the buried debris area, the on-property west ditch, the Upper South Ditch, the central drainage area, and Central Pond, 2) Soil excavation from 3 soil hot spots, 3) installation of a containment wall to contain dense aqueous liquid on the Property and installation of a temporary cap. The slurry wall is intended to reduce the discharge of contaminated groundwater to the surface water and sediments in the on-Property ditch system. A Post Construction Monitoring Plan (PCMP) was initiated to monitor the effectiveness of the wall (monitoring plan has continued and is now called the Interim Response Steps Work Plan monitoring), upgrading of the Plant B remedial system to include air sparge, soil vapor extraction and nutrient injection systems, excavation of Drum Areas A and B with characterization of soil and off-site disposal, and excavation of oily soil from the east and north banks of the Central Pond and replacement with imported soil.

Release Abatement Measures (RAM) under the MCP are typically interim measures that improve conditions (remove hot spots, reduce concentrations to acceptable levels in some areas of the site, mitigate migration, control sources, etc.) and move a site closer to final site closure (called a Permanent Solution as of 2005). In some cases a RAM may achieve final closure, but in many cases, additional remedial actions may be required to achieve final closure.

The MassDEP letter approved the Part 2 Construction Ram Completion Report, stating "DEP approves the completion of the Construction-Related RAM, including the recommended modifications to the PCMP and the re-use of the biocell sand." MassDEP stated further "However, it is clear to DEP that although activities conducted at the site have complied with the Construction policy, additional activities will be necessary in order to fulfill the requirements of a Permanent Solution."

Two additional activities identified by MassDEP were the additional investigation of the limits of Kempore in subsurface soils at the Lake Poly area and the evaluation in a feasibility study of the migration of contamination for the off-Property West Ditch dense aqueous layer source area to the South Ditch. The letter explicitly states, with regards to increased concentrations of contaminants in the South Ditch "DEP

agrees that this contamination is likely not the result of leakage or failure of the of the containment structure."

To the extent written records are available Olin has always tried to portray the history of the Site accurately and will revise statements if necessary to reflect the history here.

EPA Response

See EPA response to Olin response to General Comment #11.

11. Page 1-5, Section 1.3 – In the discussion of the slurry wall, Olin states: "The relatively flat internal gradients and lack of vertical gradients within the structure indicates the slurry wall is effectively isolating groundwater above the DAPL from groundwater outside the Containment Structure. Therefore, the Containment Structure is performing as designed as a source control measure for the on-Property DAPL Pool." EPA does not agree with this statement based on the data that is available concerning the slurry wall's performance. The equalization window allows for the continued release of contaminated groundwater, which itself prevents the Containment Area from serving as an effective source control measure for DAPL. Additionally, the data Olin has collected does not support the idea that there is no communication (flow) through or beneath the slurry wall. Monitoring has consistently shown that water table elevations outside of the slurry wall have a significant influence on the interior water table elevation. This strongly indicates there is flow occurring into and out of the Containment Area through either the slurry wall, the slurry wall/bedrock interface, through weathered bedrock under the slurry wall, or through bedrock fractures.

    An analysis of groundwater flow patterns and gradients within the slurry wall shows that the Containment Area is not functioning as intended. The slurry wall is intended to fully isolate the outside groundwater from the internal groundwater except through the equalization window. At the equalization window, flow can enter or exit the Containment Area depending on the flow gradients at the time. If the water surface is higher just outside the equalization window, flow is into the Containment Area. If the water surface just outside the window is lower, flow is out of the Containment Area. Overall, in Wilmington, high groundwater is generally around May 1st and low groundwater around October 1st every year. It follows that during the rising groundwater time (October through May) groundwater flow should be into the Containment Area via the equalization window. During the period of falling groundwater levels (May through October) flow should reverse outwards of the equalization window from the Containment Area. Roughly, about as much flow should exit the Containment Area as flowed in during the previous time-period, but variations will occur on wet and dry years. This can be visualized by a simple groundwater signal that increases part of the year resulting in flow into the Containment Area, and decreases part of the year resulting in flow out of the Containment Area.

    Within the Containment Area, if fully isolated from the outside water surface elevations, water surface contours should be semi-circles or semi-ellipses around the equalization window. Simply, a mound of water is spreading out away from the equalization window. Figure 11 of Olin's HPIT Phase II report, attached (see Appendix 3), presents this case for May 6, 2016 high groundwater condition. The groundwater elevations are a series of semi-ellipses contours around the equalization window. Conversely, a similar figure in October for low groundwater would have

similar ellipses, but the lowest contour would be at the window and increasing elevation contours of semi-ellipses away from the window.

Again, if the slurry wall is functioning as intended, points equi-distant north and south from the equalization window would have the same water surface elevation in the Containment Area.

However, a review of the figures contained Appendix E of the HPIT Phase II Report indicates a very different condition is occurring. Attached (see Appendix 3) are the figures with flow lines added to indicate flow direction on each figure. Flow directions should be either away from the equalization window or towards the window. However, that is not the case. The flow direction is more often a north to south direction, much like the outside flow field. Of note, PZ-24 in the southwest corner of the Containment Area always has the lowest water surface elevation, and GW-CA3S in the northeast corner has the highest most of the time. Clearly, the outside flow field is strongly influencing the water surface elevations in the Containment Area.

To further examine the water surface elevation data, the data from Appendix E of the HPIT Phase II Report figures were entered on a spreadsheet and plots made between two well points. This analysis as well as figures presenting data from the selected plots are attached (see Appendix 3). Groundwater elevations at GW-CA1 (at the window) are always higher than PZ-24 (the southwest corner of the Containment Area). This indicates that flow is always going from GW-CA1 to PZ-24. The only place for the flow to go at PZ-24 is through (or under) the slurry wall. Similarly, either there is no flow or flow is going from GW-CA3S (northeast corner of the Containment Area) to GW-35S (center portion of the Containment Area) eight out of nine times. Clearly GW-35S, being nearer to the equalization window, should show higher groundwater levels during part of the year than GW-CA3S. Again, there must be an additional flow source besides the window. Groundwater flow is occurring either through (or under) the north slurry wall. These findings indicate that a 'tilt' of the internal water contours is occurring due to the influence of the outside water table. The north side is higher and the south side is lower in the internal water table. So, the Containment Area is not isolated from the outside. Flow is occurring into the area from the north and out of the Containment Area in the south. The route of the flow is not known, but may be through the slurry wall, through the interface between the slurry wall and bedrock, through the weathered bedrock surface, or through the bedrock fractures.

In the Source Control FS Report, Olin shall include EPA's analysis in this comment and remove all statements which imply that the slurry wall is serving as effective containment for DAPL and contaminated groundwater.

Olin Response to Comment 11

Olin disagrees with USEPA's assessment since the assessment has made no effort to quantify mass flux. Simply showing the existence of a very small gradient (approximately 0.0004 ft/ft) across the interior of the Containment Area does not constitute evidence of leakage, especially when the gradient depicted does not account for mounding in the Containment Area due to flow in through the equalization window and leakage through the temporary cap. The slurry wall is not an impermeable barrier; it has a measurable hydraulic conductivity of less than 1E-7 cm/sec. Even with the down gradient length of Slurry Wall being on the order of 765 feet, its low K and limited saturated thickness, it should limit flux to less than several gallons per day assuming a steep gradient (.1 ft/ft) across the wall itself. The hydrologic

properties of the aquifer outside the slurry wall (K and gradient) would produce a daily flux of groundwater around the slurry wall and toward South Ditch that is three orders of magnitude larger.

Even accounting for flux through weathered bedrock, if it occurred, would be trivial compared to flow in overburden outside the Containment Area. Therefore Olin does not agree that an observation of the gradient alone supports a compelling argument to negate its' contention that the slurry wall limits migration to the extent practical, which is the performance standard for the system.

USEPA states that groundwater flowing out the equalization window is an impact, yet has failed to cite data which shows the opposite; that shallow groundwater inside the Containment Area does not exceed RSLs or primary MCLs and that groundwater outside the window and within it does.

The USEPA analysis will require further discussion and data gaps should be addressed in the Containment Area CSM before any decisions are made regarding RAOs.

EPA Response

EPA disagrees with Olin's response and reiterates its original comment. There are several lines of evidence that support the need to evaluate alternatives that provide added source control measures within the containment area. EPA notes that it has agreed to continue technical discussions with Olin regarding closing data gaps pertaining to the Containment Area. In addition, EPA notes that Olin submitted a memorandum on November 8, 2018 regarding Containment Area data gaps that EPA has responded to separately. Olin has agreed that the discussions regarding Containment Area data gaps will not affect the time frame for submission of the IAFS. See also EPA responses to Olin responses to General Comment #8 regarding RAOs.

12. Page 1-6, Section 1.4.1 – The discussion of OU1 Soil is not complete without a more detailed analysis of soil within the Containment Area, as described in General Comment 2, above. Olin shall add a more robust analysis of contamination of soils remaining within the Containment Area, at all depths.

Olin Response to Comment 12

Olin will provide additional information regarding the Containment Area as requested in General Comment #2, to the extent additional data is present that was not previously discussed in the OU1 RI.

EPA Response

See EPA response to Olin response to General Comment #2. EPA notes Olin's response and has no further comment.

13. Page 1-7, Section 1.4.3 – "The current impacts to Lower South Ditch sediment are associated with historical releases to the ditch system and not ongoing discharge of dissolved constituents to surface water" and "Current data indicate that the former sediment excavation remedies in Upper South Ditch were successful and that remaining contaminated sediment resides in the un-remediated portions of Lower South Ditch." Although EPA agrees that past releases have caused the

majority of impacts seen in the Lower South Ditch sediment, EPA believes that current ongoing groundwater discharging to the South Ditch may be re-contaminating the sediment. EPA notes that the 42 day toxicity test concluded that high toxicity levels are currently present in sediments within the South Ditch. Olin shall revise these statements in the Source Control FS Report to include the possibility of ongoing contamination to sediments resulting from groundwater input, or Olin shall provide data showing such contamination is not a concern.

Olin Response to Comment 13

Olin will provide appropriate data in the IAFS to demonstrate that recontamination is not a significant concern. Annual sediment data presented in the SASR does not indicate sediment is being recontaminated by chromium, and BEHP is not present in discharging shallow groundwater based on OU3 Groundwater data. Chromium in floc is biologically unavailable. Ammonia concentrations in lower South Ditch surface water have declined by a factor of 3 to 5 times over the last 4 to five years. This information will be provided in the IAFS as requested.

EPA Response

EPA notes Olin's response and has no further comment pending review of the IAFS.

14. Page 1-7, Section 1.4.4 -- Olin states: "The current impacts to EA5 soil are associated with historical releases to the ditch system and not ongoing discharge of dissolved constituents to surface water." See Specific Comment 13, above; Olin shall revise accordingly.

Olin Response to Comment 14

Please see response to comment 13.

EPA Response

See EPA response to Olin response to Specific Comment #13 above.

15. Page 1-8, Section 1.5 – Olin states: "The volatiles (primarily TMPs) that have been reported in subsurface soils are not located at occupied structures, and therefore are not part of a complete vapor intrusion pathway." Olin must evaluate the potential for vapor intrusion pathways, regardless of the current existence of one. Olin shall evaluate the potential for soil vapor intrusion given potential future construction and develop alternatives to address the issue.

Olin Response to Comment 15

Olin will expand the discussion in the IA FS to better explain that there are no unacceptable risks related to vapor intrusion into existing site buildings due to TMPs in soil. Vapor intrusion will be identified as a potential concern for future buildings that may be constructed in areas where TMPs are present in soil. The revised text will include potential actions that may be implemented to address vapor intrusion in future buildings and how these actions would be implemented. However, the means of mitigating vapor intrusion into future buildings will be dependent upon the location, design, construction, and use of the

potential future buildings, which are all unknown at this time. Therefore, including a vapor mitigation system for some number of buildings that may be constructed at some future location(s) and used for some unknown purpose(s) is not appropriate to include in the remedial alternatives to be evaluated in the IAFS.

EPA Response

See EPA response to Olin response to General Comment #7.

16. Page 1-8, Section 1.5 – Olin states: "Ammonia is highly water soluble and is therefore highly mobile, as its role in groundwater/surface water interaction." Olin shall correct the grammatical error (missing "is") in this sentence.

Olin Response to Comment 16

The editorial comment will be addressed.

EPA Response

EPA notes Olin's response and has no further comment.

17. Page 1-8, Section 1.5 – Olin states: "Chromium in the South Ditch surface water is present along with elevated concentrations of aluminum and iron, and forms a precipitate, or flocculant (floc) that includes all three of these metals when groundwater discharges to the South Ditch surface water. Based on the data presented in the Final OU1/OU2 RI Report, hexavalent chromium was not identified in South Ditch surface water. Formation of the floc material is driven by changes in aqueous pH and is stable in the surface water environment. The floc material is mobile, in that storm water events result in the flushing of floc from the South Ditch to downstream locations. The floc material may also be sequestered in the South Ditch by leaf fall in the autumn and that material may be incorporated into the sediment of the South Ditch." See Specific Comment 13, above and General Comment 1, above; this statement illustrates the concern with ongoing contaminated groundwater discharge to South Ditch serving as a source of new contamination to South Ditch sediments.

Olin Response to Comment 17

Studies specific to the floc long ago concluded that the floc once formed was environmentally stable under natural conditions and was not biologically available. Therefore from a biological standpoint, discharge of groundwater resulting in formation of floc will not recontamination the sediment. The points will be brought out in the text of the IAFS.

EPA Response

See EPA response to Olin response to Specific Comment #8 and Specific Comment #13. EPA notes Olin's response and has no further comment.

18. Page 1-9, Section 1.6.1 – The BHHRA does not conclude that the soil within the Containment Area is below risk levels for construction workers, as indicated in this section. Conclusions in the BHHRA are based on the existing deed notice. Any Institutional Controls that may need to be a part of the selected remedy shall be presented in the Source Control FS Report. Olin shall revise accordingly.

Olin Response to Comment 18

The BHHRA evaluated a trespasser scenario and the text will be corrected to reflect this. The institutional controls already exist and will be described under the selected remedy in the IAFS Report when it is prepared. The existing Declaration and Notice of Environmental Restriction filed with the registry of deeds does not allow excavation within the Containment Area except to maintain the current contours of the temporary cap.

EPA Response

EPA reiterates its comment that any Institutional Controls that may need to be a part of the selected remedy shall be presented in the IAFS. EPA notes that the existing Declaration and Notice of Environmental Restriction is not sufficient as an Institutional Control because it does not confer any right for enforcement of such restrictions. EPA also notes that the existing Declaration and Notice of Environmental Restriction cannot be relied upon to assume that only trespasser exposure could occur.

19. Page 1-11, Section 1.6.3 – Olin states: "The human health risk assessment indicates the Property overall is suitable for industrial/commercial use." This statement is based on existing deed restrictions and shall be modified. Olin shall present any proposed Institutional Controls as part of the Source Control FS Report.

Olin Response to Comment 19

The conclusions concerning the suitability of the property for future industrial/commercial use were based CERCLA guidance and criteria for exposure scenarios that were consistent with the existing deed restrictions. USEPA indicated to the public during a public meeting in July 2014 that low-level residual contamination existed on the 51 Eames Street property and as such, the property was suitable for redevelopment. The USEPA-approved OU1/OU2 RI Report concluded (pages ES-32 and ES-33), based on the BHHRA, "The property overall is suitable for industrial/commercial use." The RI did also conclude that TMPs in soil in the northeast corner of the Property associated with EA3 and EA7 and to a lesser extent former Lake Poly Area (EA1) could pose potential vapor intrusion risks for future building construction and occupancy. Therefore, this portion of the Site should be evaluated in a Feasibility Study for potential engineering controls and requirements to mitigate potential VI concerns. The RI further stated there is no current VI issue for existing buildings. At the time the RI Report was prepared, USEPA VI guidance indicated that management of potential VI concerns for locations without occupied buildings could best be accomplished at the time a building is proposed, by further investigation of the proposed construction site to further evaluate VI potential and, if necessary, to include vapor intrusion mitigation or elimination components in building design. Institutional mechanisms to trigger that process would likely be a component of such an approach.

EPA Response

EPA reiterates the comments in its response to Olin's response to Specific Comment #18.

20. Page 1-10, Section 1.6.1 – Olin states: "In the future it is possible for redevelopment of the property to occur in this area and new industrial/commercial buildings could be constructed that would likely require institutional and engineering controls to address or eliminate VI pathways." As described in General Comment 7, above, Olin shall provide a robust analysis of alternatives for addressing this potential exposure pathway in the Source Control FS Report.

Olin Response to Comment 20

Please See Response to General Comment #1 and Response to Specific Comment #15 and #19.

EPA Response

See EPA response to Olin response to General Comment #1 and Specific Comments #15 and #19.

21. Page 1-11, Section 1.6.3 – Olin states: "Based on recommendations in the Final OU1/OU2 RI Report (AMEC, 2015) approved by the USEPA in July 2015 (USEPA, 2015), all remedial alternatives evaluated in the OU1/OU2 FS will include installation of a permanent cap over the OU1 Containment Area, the objective of which is to continue to permanently minimize infiltration into the Containment Structure." As addressed in General Comment 3, above, this statement implies that EPA's approval of the OU1/OU2 RI constitutes the selection of a presumptive remedy in the Containment Area. This statement shall be removed, and a full range of remedial alternatives shall be evaluated for the Containment Area.

Olin Response to Comment 21

See Response to General Comment #3.

EPA Response

See EPA response to Olin response to General Comment #3.

22. Section 2.0 – The screening of remedial technologies to address OU1/OU2 soil, sediment, and surface water did not include technologies that might have potential application at the Site including soil freezing (potential containment method) and artificial controls (i.e., constructed culverts for certain areas of surface water). Solidification for sediment/soil and permeable reactive barriers for surface water should not have been screened out as potential remedial technologies. Olin shall revise this section for inclusion in the Source Control FS Report accordingly.

Olin Response to Comment 22

As stated in Response to General Comment #1, Olin will proceed with development of a IAFS Olin will develop a robust evaluation of remedial alternatives to address sources of contamination (DAPL) and control of migration of higher concentrations of Site-related impacts in downgradient groundwater. Olin does not concur that soils within in the Containment Area require additional remedial action based on the BHRRA and groundwater data.

EPA Response

See EPA response to Olin response to General Comments #1, #2 and #3 and Specific Comment #4.

23. Page 2-2, Section 2.1.1 – As noted in General Comments 2 and 3, above, the updated Draft OU1/OU2 FS Report is lacking a robust discussion of contamination remaining within the Containment Area, and has inappropriately assumed a permanent cap will be the only component of the selected remedy. Olin shall revise the FS, and submit the Source Control FS Report, in accordance with General Comments 2 and 3, above. Section 2.1.1 shall be revised to include potential vapor intrusion issues associated with soils within the Containment Area.

Olin Response to Comment 23

USEPA assumes contamination is present in soil within the Containment Areas requiring additional action. Olin does not concur with this conclusion based on remediation performed to date and available data and information. This issue will require resolution prior to completing a IAFS.

EPA Response

See EPA response to Olin response to General Comments #1, #2 and #3 and Specific Comment #4.

24. Page 2-3, Section 2.1.2 – See General Comment 8, above, regarding required revisions to the RAOs for sediment, soil, and surface water.

Olin Response to Comment 24

See Olin responses to referenced comments.

EPA Response

See EPA response to Olin response to referenced comments.

25. Page 2-4, Section 2.1.4 – Olin states: "The temporary cap was originally designed to reduce infiltration into the Slurry Wall Containment Structure by directing precipitation away from the Containment Area through an internal drain leading to a retention basin that eventually discharges to South Ditch. The objective of the permanent cap is consistent with that of the temporary cap. Therefore, the RAO for the permanent cap over the Containment Structure is: Replace the temporary cap over the Slurry Wall Containment Area with a cap that will continue to permanently minimize infiltration into the containment structure." As discussed in General Comment 3, above, Olin shall evaluate a range of alternatives for the Containment Area, including no action, excavation and off-site disposal, ex-situ treatment, in-situ treatment, and capping. Developing an RAO specific to a plan for capping is not consistent with the NCP. Additionally, as discussed in General Comment 5, above, the stated objective of the permanent cap is inadequate; Olin shall revise accordingly as required by General Comment 5.

Olin Response to Comment 25

See Olin response to General Comment #5.

EPA Response

See EPA response to Olin response to General Comment #5.

26. Page 2-5, Section 2.1.6 – Olin states: "The MCP contains a provision to avoid duplication of regulatory procedures and oversight at sites subject to multiple jurisdictions (310 CMR 40.0110). For example, the MCP states that conducting response actions at a site subject to CERCLA yields a site that is adequately regulated for purposes of compliance with the MCP (310 CMR 40.0000). Therefore, in accordance with the provisions of the MCP, the OCSS is considered adequately regulated under CERCLA. Therefore, the MCP is not considered an ARAR (neither applicable, nor relevant and appropriate) associated with response actions for OU1 and OU2." As stated in EPA's December 7, 2017 Comment Letter, this statement is not entirely accurate as written. Olin shall remove this discussion from all FS reports. The Commonwealth of Massachusetts will identify Massachusetts ARARs for this Site. Olin shall consult with the MassDEP and EPA before revising this section.

Olin Response to Comment 26

Olin agrees to discuss the relevance of the MCP as an ARAR with USEPA and MassDEP prior to developing the future FS documents.

EPA Response

Olin shall not include the discussion described in this comment in the IAFS.

27. Page 2-6, Section 2.1.6.1 – Olin states: "As discussed in Subsection 1.6.1, the BHHRA did not identify any carcinogenic risks associated with OU1 and OU2 above the CERCLA acceptable risk range of 10-4 to 1—6 or a non-cancer Hazard Index of 1." This statement is inaccurate as written as it leaves out soils in Lake Poly, the drum disposal area, the Containment Area, and Plant B. Olin shall revise accordingly. The updated Draft OU1/OU2 FS Report states that institutional controls are needed for EA1, EA3, and EA7; however, no details are provided. Olin shall include a description of any proposed Institutional Controls in the Source Control FS Report.

Olin Response to Comment 27

The text will be revised for the IAFS to accurately present the risks associated with the Site as presented in the BHHRA. The text of the IAFS will also be revised to include a description of any proposed institutional controls that may be identified for the remedial alternatives.

The BHHRA determined cancer (and non-cancer) risks to the industrial/commercial outdoor worker and indoor worker, and the future construction worker at the OU1 exposure areas (EA1, EA2, EA3, EA4, EA6, EA7, on-PWD, South Ditch, Central Pond, and the Stormwater Detention Basin), are within or below the CERCLA acceptable risk range (and below an HI of 1). Lake Poly is within EA1. Plant B is EA3. The drum disposal area is within the Containment Area for which there is only a trespasser scenario due to existing deed restrictions. The Containment Area surface soil data were surface soil was evaluated in the BHHRA. The Notice and Declaration of Restrictive Covenant filed with the Registry of Deeds prohibits excavation in the Containment Area except for shaping and grading to install a permanent cap. This eliminates future construction worker excavation exposure and any human direct contact exposure to subsurface soil in the Containment Area.

EPA Response

EPA notes Olin's response. However, it is EPA's position that the surface soil samples collected directly beneath the temporary cap represent the support layer for the geomembrane liner and not representative of deeper soil. Information previously provided by Olin documents the presence of contamination in the containment area soil. EPA and Olin have agreed to further discuss data gaps within the containment area. EPA also reiterates the comments included in EPA's response to Olin's response to Specific Comment #18 above regarding the existing Declaration and Notice of Environmental Restriction, including that the existing Declaration and Notice of Environmental Restriction cannot be relied upon to assume only trespasser exposure could occur.

28. Page 2-6, Section 2.1.6.1 – Regarding the discussion of vapor intrusion risk, see General Comment 7, above and Specific Comments #15 and #19

Olin Response to Comment 28

See the Response to General Comment #7.

EPA Response

See EPA response to Olin response to General Comment #7.

29. Page 2-9, "Ecological PRGs for South Ditch Surface Water" – Note [b] states "…assuming that salmonid fish are absent as explained in the BERA." As stated in EPA's December 7, 2017 Comment Letter, representative species are tested and used to develop the criteria; it is not acceptable to choose which species are or are not present and further adjust the criteria. The chronic concentration for ammonia is 1.9 mg/l for a pH of 7 and a temperature of 20 degrees Celsius. This is the criteria value used for cleanup at the Halls Brook Holding Area Pond for the Industri-Plex Superfund site. Olin shall revise accordingly.

Olin Response to Comment 29

South Ditch is not Halls Brook. Fish species are not present in South Ditch nor connected upstream and downstream surface water bodies. South Ditch cannot support fish habitat as the water course commonly goes dry along its middle reach in summer months. The receiving water is East Ditch, a rail road ditch

which EPA has observed and concluded has limited ecological value and which certainly is not a habitat suitable for fish. Salmonid species are not representative species for South Ditch. This request will require further review and discussion.

EPA Response

EPA disagrees and reiterates its original comment, and the IAFS shall reflect this comment. To the extent that Olin requests further clarification from EPA, EPA is willing to have additional discussions on this subject.

30. Page 2-9, "Ecological PRGs for South Ditch Surface Water" – The PRG for South Ditch Surface Water for HQ=1 for Chromium is 0.46 mg/l. There is an AWQC for Chromium VI which should also be used. The chronic criteria for Chromium VI is 0.011 mg/l (11 ug/l). Olin shall revise the table accordingly.

Olin Response to Comment 30

Olin previously provided USEPA, at their request, guidance documents that supported the PRG of 0.46 mg/L. The FS will reference and discuss the USEPA document if required. However, surface water was non-detect for Cr VI, and the PRGs for surface water should not need to consider Cr VI.

EPA Response:

Olin shall reference and discuss the USEPA document. EPA agrees that the PRGs for surface water do not need to consider Cr VI if it is non-detect in surface water at a method detection limit lower than the NRWQC for Cr VI. If Cr VI is non-detect in surface water, but total chromium is detected, Olin shall compare the detected concentrations of total chromium in surface water with the hardness-adjusted NRWQC for trivalent chromium (Cr III) based on the measured hardness of the surface water in the stream.

31. Page 2-10, Section 2.1.7.2 – Olin states: "The proposed remediation area is assumed to be one foot deep; however, the actual remediation will be based on the actual type of material encountered. That is, the remediation will address the organic sediment and soil associated with Lower South Ditch, but not the underlying mineral soils." As stated in EPA's December 7, 2017 Comment Letter, Olin shall provide further explanation for why the proposed remediation area is assumed to be only one-foot deep. Additionally, Olin shall provide an explanation for why contamination in underlying mineral soils will not be addressed. Please note that the cleanup must either meet an acceptable cleanup value for the sediments, or if not feasible to achieve the numerical standard, then a cap or other alternatives must be proposed as a component of the alternative. The revision shall also address the possibility of recontamination of sediments from groundwater and surface water. In the Source Control FS Report, Olin shall provide a figure indicating the respective groundwater areas that provide flow to the South Stream and EA5. For each contributing area, Olin shall present the concentrations of ammonia and chromium in these areas. A basic conceptual model of the groundwater flow area for both South Stream and EA5 shall be developed to determine the groundwater areas that must be addressed.

Olin Response to Comment 31

The uniform 1- foot value was used to establish a volume estimate for costs. With the stream channel, some areas will be deeper. In other broader flood plain soil areas the thickness tapers to less than a foot.

Prior to conducting a removal action Olin would conduct additional sampling to confirm depth and extent above PRGs to inform the excavation plan. This sampling would define the cleanup limits prior to the action.

BEHP is not present in groundwater and Cr in floc is not biologically available, and therefore re-impacting sediment from groundwater interaction is not a reasonable concern with respect to ecological risks.

Groundwater discharging to South Ditch ultimately flows into EA5 and the majority of the impacted sediments are in the thin adjoining floodplain. The distribution of Cr and ammonia and in groundwater and surface water is already well established by the quarterly monitoring presented in the SASRs and the OU3 RI. Additional discussion of the data will be presented in the Source Control FS.

EPA Response:

EPA reiterates its comment, which Olin shall address in the IAFS.

32. Page 2-10, Section 2.1.7.3 -- See General Comment 2, above, regarding the need to evaluate alternatives in addition to capping for the Containment Area.

Olin Response to Comment 32

See Response to General Comment #2.

EPA Response:

See EPA's response to Olin's response to General Comment #2.

33. Page 2-10, Section 2.1.7.4 – Olin shall provide a figure which delineates the area and associated volume of soil containing TMP concentrations above background.

Olin Response to Comment 33

Olin will include a figure that depicts the areas of soil with TMP concentrations above background and revised text that describes these areas and the associated estimated volume of TMP-impacted soil. EPA should note there is no background value for TMPs. Olin will use the analytical reporting limits in this assessment.

EPA Response:

EPA notes Olin's response and has no further comment.

34. Page 2-10, Section 2.1.7.5 -- See General Comment 7, above, regarding evaluation of VI risk and remedial alternatives.

Olin Response to Comment 34

See Response to General Comment #7.

EPA Response:

See EPA's response to Olin's response to General Comment #7.

35. Page 2-13, Section 2.3.2.1 – In the Source Control FS Report, Olin shall divide the discussion in this subsection into separate discussions for each soil and sediment source area. It is not clear which technologies were retained and which were eliminated for each soil and sediment source.

Olin Response to Comment 35

The text will be revised for the IAFS to provide a discussion of technology screening separately for soil and sediment as requested by the comment. In regard to South Ditch and EA5, sediment is organic soil within the channel and soil is the organic soil outside the channel but contiguous with it.

EPA Response:

EPA notes Olin's response and has no further comment.

36. Page 2-13, Section 2.3.2.2 – Olin inappropriately dismisses all technologies for the treatment of surface water. Olin shall develop a series of remedial alternatives based on the technologies available so that they can be fully evaluated in the Source Control FS Report.

Olin Response to Comment 36

The IAFS will include remedial technologies applicable to surface water contamination, based on the revised CSM.

EPA Response:

EPA notes Olin's response and has no further comment.

37. Page 2-14, Section 2.3.2.3 – See General Comment 7, above, regarding evaluation of VI risk and remedial alternatives.

Olin Response to Comment 37

See Response to General Comment #7.

EPA Response:

See EPA's response to Olin's response to General Comment #7.

38. Page 3-2, Section 3.1 – Olin states: "The USEPA-approved Final OU1/OU2 RI Report (USEPA, 2015) recommended installation of a permanent cap over the Slurry wall and Containment Area structure to replace the current temporary cap. The objective is to replace the temporary cap over the Slurry Wall Containment Area with a permanent cap to continue to minimize infiltration into the Containment Structure. Placement of a permanent cap over the Containment Area is also a binding contractual requirement under the current Purchase and Sale Agreement that exists for sale of the property. Therefore, remedial alternatives will consist of installation of a permanent cap over the OU1 Slurry Wall Containment Area." See General Comment 3, above, as well as Specific Comment 16, above. Olin shall revise accordingly.

Olin Response to Comment 38

See Response to General Comment #3.

Please note that the comment incorrectly references Specific Comment #16, which refers to the solubility of ammonia, and has nothing to do with potential capping of the Containment Area.

EPA Response:

See EPA's response to Olin's response to General Comment #3.

39. Page 4-5, Section 4.2 – Olin states: "Therefore, re-vegetation of the excavated area would not be performed beyond the extent necessary as a temporary measure and the area would be allowed to recover naturally, which is the same as the approach used during the 2000-2001 remediation effort in Upper South Ditch." Olin failed to respond to EPA's December 7, 2017 Comment Letter which stated that "the alternative shall be revised to include a plan for replanting this area with appropriate species and monitoring its recovery." Olin shall provide a plan for replanting and monitoring of this area in the Source Control FS Report.

Olin Response to Comment 39

The need for re-planting and restoration, as well as long-term monitoring, following remediation of Lower South Ditch will be addressed in the revised text of the IAFS when completed. The Olin case team will revisit the location since the areas maybe be better suited to natural recovery which is also a well-established and acceptable approach to wetland restoration.

EPA Response:

EPA notes Olin's response and has no further comment.

40. Page 4-7, Section 4.2.2 – Olin states: "The asphaltic cap would be designed and constructed to continue to permanently minimize infiltration into the Containment Structure. Historical disposal areas within the Containment Structure have been removed and listed or characteristic hazardous waste are not currently present in shallow soil (e.g., 10 – 15 ft) within the Containment Area. The DAPL surface within the Containment Area is approximately 35 ft below ground surface and deed covenants are currently in place prohibiting intrusive activities within the Containment Structure. As such, the cap is not intended to prevent exposure to hazardous waste, and therefore RCRA regulations are not directly applicable to a cap constructed to meet the intended objective." See General Comment 2, above, regarding required discussion of contaminants within the Containment Area. See General Comment 5, above, regarding the performance objectives of a final cap. If the Source Control FS Report concludes hazardous waste will be left in place in the Containment Area (i.e., contaminated soils or DAPL) then the
Containment Area / cap must meet RCRA regulations. Olin shall revise accordingly.

Olin Response to Comment 40

See Responses to General Comments #2, #3, and #5 regarding the Containment Area, potential hazardous waste that may remain in-place, and performance objectives associated with the capping alternatives.

EPA Response:

See EPA's responses to Olin's responses to General Comments #2, #3, and #5.

41. Page 4-8, Section 4.2.4 – Olin states: "The alternative provides long-term effectiveness…" EPA does not agree with this statement for reasons described in General Comment 5, above. This alternative would allow for continued dissolution and spreading of hazardous wastes within the Containment Area. Olin shall remove or revise this statement.

Olin Response to Comment 41

As stated in the Response to General Comment #1, the USEPA has identified potential data gaps related to contamination sources, such as the containment area and DAPL, and request that these data gaps be addressed in order to revise the CSM.

As stated in the Response to General Comment #5, the IAFS will include revised text for the evaluation of the capping alternatives, including additional rationale regarding the alternatives' compliance with ARARs.

USEPA has not established the presence of hazardous wastes within the Containment Area soils located above the water table or within shallow groundwater. Shallow groundwater quality data available within the Containment Area does not suggest the presence of hazardous wastes within the shallow soils or in the vadose zone.

EPA Response:

See EPA's responses to Olin's responses to General Comments #1, #3 and #5. EPA disagrees with Olin's statements regarding the presence of contaminants in soil within the containment area.

42. Page 4-11, Section 4.3.2 -- Olin states: "The objective of the cap is to replace the temporary cap over the Slurry Wall Containment Area with a cap to continue to permanently minimize infiltration into the Containment Structure. Historical disposal areas within the Containment Structure have been removed and listed or characteristic hazardous waste are not currently present in shallow soil (e.g., 10 – 15 ft) within the Containment Area. The DAPL surface within the Containment Area is approximately 35 ft below ground surface and deed covenants are currently in place prohibiting intrusive activities within the Containment Structure. As such, the cap is not intended to prevent exposure to hazardous waste, and therefore RCRA regulations are not directly applicable to a cap constructed to meet the intended objective." See General Comment 2, above, regarding required discussion of contaminants within the Containment Area. See General Comment 5, above, regarding the performance objectives of a final cap. If the Source Control FS Report concludes hazardous waste will be left in place in the Containment Area (i.e., contaminated soils or DAPL) then the Containment Area / cap must meet RCRA regulations. Olin shall revise accordingly.

Olin Response to Comment 42

See Responses to General Comments #2, #3, and #5 regarding the Containment Area, potential hazardous waste that may remain in-place, and performance objectives associated with the capping alternatives.

Olin notes that the MassDEP, in a letter of March 29, 2005, fully approved the *Part 2 Construction RAM Status Report No. 8 (*submitted to MassDEP on September 7, 2004) and *the Completion Report and Addendum to Status Report No. 8 (submitted on October 4, 2004).* The MassDEP letter is attached to this RTC package. The construction of the slurry wall containment structure and the installation of the temporary cap were included among the activities approved by the March 29, 2005 letter.

EPA Response:

See EPA's responses to Olin's responses to General Comments #2, #3, and #5.

43. Page 4-11, Section 4.3.3 -- Olin states: "The alternative provides long-term effectiveness…" EPA does not agree with this statement for reasons described in General Comment 5, above. This alternative would allow for continued dissolution and spreading of hazardous wastes within the Containment Area. Olin shall remove or revise this statement.

Olin Response to Comment 43

As stated in the Response to General Comment #1, the USEPA has identified potential data gaps related to contamination sources, such as the Containment Area and DAPL, and request that these data gaps be addressed in order to revise the CSM.

As stated in the Response to General Comment #5, the IAFS will include revised text for the evaluation of the capping alternatives, including additional rationale regarding the alternatives' compliance with ARARs.

Olin does not agree with USEPA's assertion the alternative would allow for continued dissolution and spreading of hazardous wastes within the Containment Area. USEPA simply makes the assertion but does not provide any technical analysis to support it.

EPA Response:

See EPA's responses to Olin's responses to General Comments #1 and #5.

44. Page 4-11, Section 4.4.2 – Olin states: "The objective of the cap is to replace the temporary cap over the Slurry Wall Containment Area with a cap to continue to permanently minimize infiltration into the Containment Structure. Historical disposal areas within the Containment Structure have been removed and listed or characteristic hazardous waste are not currently present in shallow soil (e.g., 10 – 15 ft) within the Containment Area. The DAPL surface within the Containment Area is approximately 35 ft below ground surface and deed covenants are currently in place prohibiting intrusive activities within the Containment Structure. As such, the cap is not intended to prevent exposure to waste materials, and therefore RCRA regulations are not directly applicable to a cap constructed to meet the intended objective." See General Comment 2, above, regarding required discussion of contaminants within the Containment Area. See General Comment 5, above, regarding the performance objectives of a final cap. If the Source Control FS Report concludes hazardous waste will be left in place in the Containment Area (i.e., contaminated soils or DAPL) then the Containment Area / cap must meet RCRA regulations. Olin shall revise accordingly.

Olin Response to Comment 44

See Responses to General Comments #2, #3, and #5 regarding the Containment Area, potential hazardous waste that may remain in-place, and performance objectives associated with the capping alternatives.

EPA Response:

See EPA's responses to Olin's responses to General Comments #2, #3, and #5.

45. Page 4-15, Section 4.4.4 – Olin states: "The alternative provides long-term effectiveness…" EPA does not agree with this statement for reasons described in General Comment 5, above. This alternative would allow for continued dissolution and spreading of hazardous wastes within the Containment Area. Olin shall remove or revise this statement.

Olin Response to Comment 45

As stated in the Response to General Comment #1, the USEPA has identified potential data gaps related to contamination sources, such as the containment area and DAPL, and request that these data gaps be addressed in order to revise the CSM.

As stated in the Response to General Comment #5, the IAFS will include revised text for the evaluation of the capping alternatives, including additional rationale regarding the alternatives' compliance with ARARs.

EPA Response:

See EPA's responses to Olin's responses to General Comments #1 and #5.

46. Page 4-17, Section 4.5.1 – Olin states: "Alternatives 2A, 2B, and 2C, Limited Action, Excavation with Off-site disposal, and Cap (Asphaltic, RCRA Subtitle C, or RCRA Subtitle D, respectively) are equally protective of human health and the environment. These three alternatives remove soil and sediment with COC concentrations above PRGs, continue to monitor surface water in South Ditch to achieve PRGs, and include a cap to continue to permanently minimize infiltration into the Containment Structure. Alternatives 2A, 2B, and 2C also include institutional controls to prevent a potential vapor intrusion exposure in future buildings at the site." This statement is inaccurate as outlined in the comments above. The three cap types are not equally protective, as explained in General Comment 5, above. The vapor intrusion alternatives are not adequately developed, as explained in General Comment 7, above. Olin shall revise accordingly.

Olin Response to Comment 46

As stated in the Response to General Comment #5, the IAFS will include revised text for the evaluation of the capping alternatives, including additional rationale regarding the alternatives' compliance with ARARs.

As stated in the Response to General Comment #7, Olin will expand the discussion in the IAFS to better explain that there are no unacceptable risks related to vapor intrusion into existing site buildings due to TMPs in soil. Vapor intrusion will be identified as a potential concern for future buildings that may be constructed in areas where TMPs are present in soil. The revised text will include potential actions that may be implemented to address vapor intrusion in future buildings and how these actions would be implemented. However, the means of mitigating vapor intrusion into future buildings will be dependent upon the location, design, construction, and use of the potential future buildings, which are all unknown at this time. Therefore, including a vapor mitigation system for some number of buildings that may be constructed at some future location(s) and used for some unknown purpose(s) is not appropriate to include in the remedial alternatives to be evaluated in the IAFS.

EPA Response:

See EPA's responses to Olin's responses to General Comments #1 and #7.

47. Page 4-17, Section 4.5.4 – Olin states: "Alternative 1, No Action, is not effective in the long term. Alternatives 2A, 2B, and 2C, Limited Action, Excavation with Off-site disposal, and Cap (Asphaltic, RCRA Subtitle C, or RCRA Subtitle D, respectively) are equally effective in the long term." This statement is inaccurate and shall be removed or modified. See General Comment 5, above.

Olin Response to Comment 47

As stated in the Response to General Comment #1, the USEPA has identified potential data gaps related to contamination sources, such as the containment area and DAPL, and request that these data gaps be addressed in order to revise the CSM.

As stated in the Response to General Comment #5, the IAFS will include revised text for the evaluation of the capping alternatives, including additional rationale regarding the alternatives' compliance with ARARs.

EPA Response:

See EPA's responses to Olin's responses to General Comments #1 and #5.

48. Tables 1, 2, and 3 – In these tables, Olin routinely screens out an individual technology because it may work for some COCs but not for others. It is common to develop remedial alternatives that include combined remedial technologies to achieve RAOs. The final remedial action may include different remedial technologies implemented in separate areas of OU1 and OU2. Olin shall revise all FS reports to include consideration of combining technologies; individual technologies should not be excluded during the preliminary evaluation.

Olin Response to Comment 48

The comment incorrectly refers to Tables 1, 2, and 3, which do not exist in the Draft OU1/OU2 FS. Olin assumes the comment is referring to Tables 2.3-1 and 2.3-2, the screening of remedial technologies for soil/sediment, and surface water, respectively.

The IAFS will present the screening of remedial technologies by media. The screening of technologies, and the development and evaluation of remedial alternatives will consider a combination of technologies, as appropriate, based on a revised CSM to be agreed to between Olin and the USEPA.

EPA Response:

EPA notes Olin's response and further notes that EPA understands that Olin will submit the IAFS to EPA even though a CSM has not been agreed to between Olin and the EPA.

49. Tables 2.1-1, 2.1-2 and 2.1-3 (ARARs Tables) - Olin shall replace Tables 2.1-1, 2.1-2, and 2.1-3 with new tables that use Appendix 6 - Attachment 1 (Potentially Applicable or Relevant and Appropriate Requirements and To Be Considered Advisories, Criteria or Guidance**)** and Appendix 6 - Attachment 2 (Evaluation of Compliance with ARARs and TBCs for All Media**)** to these comments as a starting point for further development in the Source Control FS Report. Appendix 6 - Attachment 1 includes tables of potentially applicable or relevant and appropriate requirements ("ARARs") and "to be considered" advisories, criteria or guidance ("TBCs") that are location-specific, chemical-specific, and action specific. Appendix 6 - Attachment 2 includes tables that show the required level of alternative-specific ARAR analysis required for an FS. The tables included in Appendix 6 - Attachment 2 are provided as examples only to show the level of ARAR analysis required for each remedial alternative included in all FS reports. Due to the lack of remedial alternatives developed and evaluated in the Draft OU1/OU2 FS Report, the associated ARAR analysis is similarly deficient. All FS reports shall contain a detailed analysis of each remedial alternative that summarizes which requirements are

applicable or relevant and appropriate (or TBC) for each alternative and describes how each alternative meets these requirements. When an ARAR will not be met, the basis for justifying one of the six ARAR waivers provided by CERCLA § 121(d)(4) shall be discussed. EPA reserves the right to provide further comments regarding the ARAR analysis completed in all FS reports.

Olin Response to Comment 49

Olin will engage USEPA in further discussion on development and presentation of ARARs tables as the FS documents are developed

EPA Response:

EPA reiterates its original comment in its entirety, including that the IAFS shall contain a detailed analysis of each remedial alternative that summarizes which requirements are applicable or relevant and appropriate (or TBC) for each alternative and describes how each alternative meets these requirements, using the format provided in the referenced Appendix 6 – Attachments 1 and 2. When an ARAR will not be met, the basis for justifying one of the six ARAR waivers provided by CERCLA §121(d)(4) shall be discussed. To the extent that Olin requests further clarification from EPA regarding ARARs, EPA is willing to have additional discussions.

50. Table 2.3-1 – Olin shall split this table in to multiple new tables, one for each source of contamination (TMPs, Containment Area, PCBs, south ditch sediment, EA5 soils, etc.). These sources may require separate treatment alternatives.

Olin Response to Comment 50

Olin will develop tables as requested.

Olin and USEPA need to come to consensus on what constitutes Source Area for OU1 and OU2. EPA has already withdrawn PCBs and Olin further believes that soils with the Containment Area do not constitute a source. Once these larger issues are resolved the structure of the ARARs analysis and presentation of tables can be discussed and agreed upon. TMPs are similarly a VI issue and should be addressed by engineering controls rather than development of remedial alternatives.

EPA Response:

As stated above, the soils in the Containment Area are source materials and shall be evaluated as such in the IAFS. A range of possible engineering controls shall be presented for VI.

51. Table 2.3-2 – Given that the South Ditch is contaminated by shallow overburden groundwater, technologies screened must also include options to prevent or treat groundwater contamination. As stated in General Comment 1, above, Olin shall combine the FS reports into one Source Control FS Report so that they are not separated by operable unit, and in the process, address the impact of interactions between groundwater, surface water, and sediment.

Olin Response to Comment 51

Olin will evaluate alternatives to mitigate surface water impacts from discharging groundwater. Olin will first develop the IAFS to address DAPL in the Main Street and off-PWD area and down gradient migration of impacted groundwater. As CSM data gaps are resolved regarding other areas, they will also be addressed.

EPA Response:

See EPA response to Olin's response to General Comment 1. The IAFS shall include alternatives that control sources in all OUs.

52. Appendix A – Olin shall include figures showing areas of exceedances for all OU1/OU2 source areas, not just sediment and EA5 soils.

Olin Response to Comment 52

Appendix A will be revised to include areas of exceedances for the various media that will be addressed in the IAFS, based on the revised CSM to be agreed to between Olin and the USEPA.

EPA Response:

EPA understands from discussions with Olin that Olin will submit the IAFS even though Olin and EPA have not reached agreement upon a revised CSM. Accordingly, Olin shall revise Appendix A as described in the comment notwithstanding the fact that Olin and EPA have not reached agreement upon the CSM.

APPENDIX 7

EPA Comments on Draft Operable Unit 3 Feasibility Study (March 30, 2018) Olin Chemical Superfund Site, Wilmington, Massachusetts

GENERAL COMMENTS

1. Olin submitted two separate draft Feasibility Study (FS) Reports, one for OU1/OU2 and one for OU3. Please see Appendix 6, for comments on how these two separate Reports shall be combined and developed. For the purposes of these comments, the FS focused on identifying and evaluating source control alternatives for all OUs is referred to as the "Source Control FS." For the purposes of these comments, the FS that will include a full range of groundwater response alternatives that restore the aquifer is referred to as the "Further Groundwater Response Action FS" or "Further Groundwater FS."

Olin Response to Comment 1

Olin has agreed to conduct and Interim Action Feasibility Study (IAFS) that focuses on DAPL mass reduction and control of downgradient migration of dissolved constituents in the Ipswich Watershed. This FS in part supplants components of the proposed Source Control FS.

The USEPA has identified potential data gaps related to contamination sources, such as the Containment Area and DAPL, and requested that these data gaps be addressed in order to revise the site CSM. The Olin and USEPA teams are in discussion related to those data gaps and will be developing a work plan to address data gaps. After Olin and the USEPA agree upon these Responses To Comments (RTC), Olin will revise the OU3 RI Report. In the meantime, Olin will develop an IAFS. Olin will proceed with development of the OU1, OU2 and OU3 Further Groundwater FS once the OU3 RI has been approved and all identified data gaps have been closed and approved. The scope of these documents will require and benefit from additional discussion and definition based on deliberation of the Olin and USEPA site teams.

EPA Response to Olin Response to Comment 1

EPA notes that Olin has agreed to develop an IAFS which addresses sources of contamination in all OUs, including OU1, OU2, and OU3. In groundwater, Olin has agreed to evaluate source control alternatives for both DAPL and areas of highly contaminated groundwater. EPA understands that Olin plans to submit the IAFS by April 11, 2019. Data gaps will continue to be evaluated through a separate Data Gaps Work Plan. See EPA's Response to Olin's Response to Comment 1 of Appendix 1 regarding the submission of the IAFS, the RI, and the Data Gaps Work Plan.

2. Numerous inadequacies identified in the Draft OU3 FS Report stem from issues with the Draft OU3 RI Report. Olin shall revise the Draft OU3 RI Report in accordance with EPA comments and submit the Source Control FS Report which incorporates these changes.

Olin Response to Comment 2

As stated in the Response to General Comment #1, Olin will proceed with development of an IAFS. After additional data gap investigations are completed, and Olin and USEPA agree upon a revised CSM, and the revised OU3 RI Report is submitted, Olin will continue to develop the OU1, OU2 and OU3 Further Groundwater FS. It is expected that further discussion will be required to define the scope and focus of these documents.

EPA Response to Olin Response to Comment 2

See EPA's Response to Olin's Response to Comment 1 of Appendix 1 regarding the submission of the IAFS, the RI, and the Data Gaps Work Plan.

3. The RAOs developed for OU3 are inadequate and shall be revised as follows:

   i. Currently stated: For overburden and bedrock groundwater within Zone II of the Municipal Water Supply Wells (MWSWs) in the Ipswich watershed and the zone of contribution to two residential wells on Cook Avenue in the Aberjona watershed: prevent exposure via potable use to constituents of concern at concentrations that are 1) associated with cancer risk greater than 1x10-4 and/or hazard Index greater than one, and 2) above drinking water Maximum Contaminant Levels.

   Revise to state: Restore contaminated groundwater to concentrations allowing for unrestricted use (achieve a cancer risk less than 1e-6 and a non-cancer hazard index of less than one for ingestion/dermal contact/vapor inhalation) of potable groundwater in both impacted watersheds. Minimize to the extent practicable the migration of contaminated groundwater and prevent the discharge of contaminated groundwater to surface water.

   ii. Currently stated: Prevent exposure to DAPL.

   Revise to state: Prevent human exposure to DAPL and groundwater containing contaminants exceeding ARARs and risk-based concentrations.

   iii. Currently stated: Reduce, to the extent practicable, mobility or volume of DAPL constituents in the DAPL pools that present a source of long-term impacts to groundwater and surface water.

   Revise to state: Prevent migration of DAPL and contaminated groundwater acting as a source (including penetration into bedrock), diffusion into groundwater, and discharge to surface water.

Olin Response to Comment 3

While an RAO to "Restore contaminated groundwater to concentrations allowing for unrestricted use" may be appropriate for a Further Groundwater FS, groundwater restoration is not an appropriate RAO for the IAFS.

Since groundwater is not a "source material" as defined by the USEPA, including an RAO to prevent human exposure to contaminated groundwater is not appropriate for the Interim Action FS or future Source Control FS, but is more applicable to the future Groundwater FS that is being required by the USEPA.

An RAO to prevent migration of contaminated groundwater may be appropriate for the future Further Groundwater FS, but is not appropriate for the IAFS.

The Olin Site team will work with the USEPA Site team to arrive at RAOs that are appropriate for each FS, media and that are consistent with RAOs established for other Region 1 Sites.

EPA Response to Olin Response to Comment 3

EPA agrees that the RAOs for the IAFS are different than those needed for the FS that deals with comprehensive groundwater restoration. For the IAFS, EPA maintains that the following RAOs are appropriate:

> Minimize to the extent practicable the migration of contaminated groundwater and prevent the discharge of contaminated groundwater to surface water.
>
> Prevent human exposure to DAPL and groundwater containing contaminants exceeding ARARs and risk-based concentrations.
>
> Prevent migration of DAPL and highly contaminated groundwater (groundwater with concentrations of NDMA greater than 11,000 ng/l) acting as a source (including penetration into bedrock), diffusion into groundwater, and discharge to surface water.

EPA also notes that currently there are residences being provided bottle water due to contamination by COCs in their wells. EPA believes that the IAFS shall include an evaluation of alternatives to address this issue and that such an evaluation should not be delayed until the final remedy for groundwater has been selected for the site.

4. Olin states that TMPs in groundwater are currently being partially addressed by the LNAPL extraction system. However, there is no detailed discussion of the impacts to groundwater. In the Source Control FS Report, Olin shall discuss the groundwater impacts in greater detail and explain why this area of contamination is not considered for further remedial action in the FS. If appropriate, Olin shall develop RAOs and remedial alternatives to address groundwater impacts and residual LNAPL.

Olin Response to Comment 4

Olin shall include contoured analyte distribution figures for TMPs in the revised OU3 RI and that information will also be discussed in the IAFS.

EPA Response to Olin Response to Comment 4

EPA notes Olin's response. If appropriate, Olin shall develop RAOs and remedial alternatives in the IAFS to address LNAPL as a source control measure.

5. The potential presence of DAPL in bedrock has not been adequately discussed. While this issue is discussed in the Draft OU3 RI Report, that discussion is incomplete (see Appendix 1 comments). Olin shall develop alternatives to address the presence of DAPL and contaminated groundwater in bedrock fractures.

Olin Response to Comment 5

Olin and USEPA are engaged in discussion of data gaps. The current evidence for DAPL in bedrock is limited (one port in MP-4, former GW-43D, and GW-83D) and in most part, the impact to bedrock in the vicinity of the DAPL pools has been shown to be diffuse groundwater. Alternatives to address DAPL in bedrock cannot be completed until Olin and USEPA are in agreement on the CSM for DAPL in bedrock. Our initial impression is that the mass in bedrock as DAPL is very small compared to mass in DAPL within the just the Main Street DAPL pool. The efficacy of mass removal from such large sources should be established and proven before resources are expended on diminutive sources.

EPA Response to Olin Response to Comment 5

In the IAFS, Olin shall develop remedial alternatives which address both DAPL and "hot spots" of highly contaminated groundwater in both overburden and bedrock. EPA acknowledges additional data will help to refine the presence of DAPL in bedrock. However, the collection of additional data and refinement of the CSM shall not prevent the development of source control alternatives in the IAFS. The IAFS shall address both DAPL and "hot spots" of highly contaminated groundwater in overburden and bedrock as their distribution is currently understood by Olin.

6. In EPA's December 7, 2017 comments on Olin's Draft Focused Feasibility Study Report for OU3 DAPL, Olin was directed to substantiate or remove claims that convective mixing of contaminants in groundwater during Facility operations was the primary cause of groundwater contamination in the overlying aquifer. Ongoing diffusion from DAPL was dismissed as a minor source. This issue was not corrected in the Draft OU3 FS Report, and Olin has still failed to provide any evidence to support these claims. Olin shall provide data supporting these statements or remove them from all FS reports.

Olin Response to Comment 6

Olin believes USEPA has misinterpreted Olin's discussion. Literature published by Lawrence Livermore Laboratory (1990) and others establishes that density driven flow on sloping aquifers is accompanied by extensive convective mixing as the dense aqueous phase liquid migrates downslope. The purpose of this discussion was to place in historical context contaminant migration mechanisms that resulted in widespread impacts to the MMB aquifer. Those mechanisms are no longer operating today since the DAPL is no longer being produced and remaining DAPL is constrained by the bedrock topography and is not moving gravimetrically as it had historically. Such wide spread impacts to the aquifer by convective

mixing are simply part of the expected historical fate and transport of contaminants many decades ago and should be acknowledged. It is theoretically reasonable that the mass of dissolved constituents released to overburden groundwater was substantially larger when the initial migration of DAPL was ongoing that it is today when the DAPL is contained within bedrock depressions and is no longer actively moving.

The current mode of migration of the DAPL constituents is by diffusion to groundwater overlying DAPL and advective transport, in addition to migration to bedrock groundwater underneath the DAPL pool with concomitant diffusion and dilution and subsequent transport within the fractured bedrock aquifer under hydraulic gradients in accordance with the frequency and degree of interconnection of the fractures in bedrock. The mass flux in overburden and bedrock is then a function of the transmissivity and gradients within those aquifers. The transmissivity and porosity of the overburden aquifer is substantially greater than bedrock. The concentration of dissolved constituents and mass flux are not proportional.

EPA Response to Olin Response to Comment 6

EPA does not disagree that the convective mixing described by Olin was a major contributor of the currently observed widespread impacts to the MMB aquifer. However, EPA maintains it is important to make clear that ongoing diffusion of DAPL constituents and advective transport of contaminated groundwater is the reason groundwater remains highly contaminated within the aquifer. EPA believes the effect of ongoing diffusion of contaminants from DAPL was overly minimized in the OU3 FS. In the IAFS, Olin shall ensure the significant effect diffusion has on maintaining and/or spreading contamination within the MMB aquifer is not minimized.

7. The Draft OU3 FS Report largely defers a discussion of the integrity of the slurry wall to the Draft OU1/OU2 FS Report. Please see Appendix 6 on the need to provide a more robust discussion of the slurry wall in the Source Control FS Report.

Olin Response to Comment 7

The text will be revised for the IAFS to provide more details regarding the contamination present within the Containment Area and the integrity of the slurry wall. However, as stated in Response to General Comment #1, Olin will proceed with development of an IAFS followed by a Further Groundwater FS after additional data gap investigations are completed. Olin and USEPA are not in agreement with respect to the role of the Containment Area on adjacent impacts to groundwater such as GW-202D and the degree of competency of bedrock directly underlying DAPL in the middle of the Containment Area. Olin and USEPA have agreed to develop a plan to address these data gaps and upon which to revise the CSM. Olin will provide additional detail on the Containment Area CSM once these data gap investigations are completed. The IAFS will not consider alternatives for removal of DAPL from the containment area until these data gaps are closed.

EPA Response to Olin Response to Comment 7

As noted in EPA Response to Olin Response to Comment 1, EPA understands that Olin has agreed to develop an IAFS which addresses source control alternatives, including alternatives for removal of DAPL from the containment area. Data gaps and the CSM will continue to be evaluated through a separate

Data Gaps Work Plan. The IAFS shall not be delayed by the continued collection of data and refinement of the CSM. See EPA's Response to Olin's Response to Comment 1 of Appendix 1 regarding the submission of the IAFS, the RI, and the Data Gaps Work Plan.

8. In EPA's December 7, 2017 Comment Letter, Olin was directed to remove statements that potential human exposure to DAPL is unrealistic. In the Draft OU3 FS Report, these claims persist. As previously stated by EPA, the majority of DAPL is located off of Olin's property and extends approximately ¾ of a mile to the west-northwest. The DAPL pools are located under homes and active businesses and there are no ordinances or other controls to prevent private owners from installing wells or conducting activities that could result in exposure. Olin shall delete all statements implying that exposure to DAPL is unrealistic as these statements will not change the RAOs for the Site.

Olin Response to Comment 8

Olin has conducted HHRA exposure to consumption of DAPL as requested by USEPA. Due to the chemical and physical nature of DAPL Olin maintains its position that a person would not voluntarily drink DAPL; even once, much less over the period of time required to be considered in the risk assessment. All homes overlying the DAPL pool on Main Street already receive municipal water. The only business with wells was Sanmina. The Sanmina (formerly Altron) wells are two former industrial production wells (B1 and B2) that are screened in overburden above the Main Street DAPL pool. The wells were used to supply industrial process water and were not used for potable purposes. Sanmina ceased operations at the facility on September 15, 2004 and the wells have been inactive since then. The operation of those wells is subject to a monitoring plan and reporting requirement to the MassDEP under the MCP.

EPA Response to Olin Response to Comment 8

EPA maintains that consumption of DAPL, while unlikely, is possible due to the reasons described in comment eight above. In the IAFS, Olin shall remove statements which claim that potential human exposure to DAPL is unrealistic or present both positions.

9. The Draft OU3 FS Report does not adequately indicate how the "primary COCs" for OU3 were developed (risk based, mass based, distribution based, etc.). Olin shall provide a discussion of how the primary COCs were determined in the Source Control FS Report.

Olin Response to Comment 9

The text will be revised for the IAFS to reflect how the COCs were developed as part of the Baseline Human Health Risk Assessment (BHHRA). As stated in Response to General Comment #1, Olin will proceed with development of an IAFS followed by a Further Groundwater FS after additional data gap investigations are completed, Olin and USEPA agree upon a revised CSM, and the revised OU3 RI Report is submitted.

EPA Response to Olin Response to Comment 9

As described above, EPA understands that Olin has agreed to develop and submit the IAFS by April 11, 2019 and will continue to develop the revised OU3 RI. The IAFS (which will address source control alternatives) and Interim OU3 RI shall not be delayed by additional data gap investigations and refinement of the CSM.

10. The remedial alternatives developed to address OU3 contamination are inadequate and poorly developed. Issues include:

    - Lack of alternatives for DAPL containment and or removal. In the alternatives proposed by Olin, the only source control action for DAPL is extraction from the Off-PWD DAPL Pool, and this source control measure is poorly developed (Olin only evaluated the continued operation of the one existing DAPL extraction well). There are no alternatives proposed in which DAPL is removed from the Containment Area, the Main Street DAPL pool, and bedrock. Olin shall evaluate alternatives in which all known DAPL areas are contained or removed from the bedrock and overburden. Olin shall evaluate an appropriate range of pumping alternatives (i.e., multiple wells, horizontal wells, etc.) within each of these DAPL extraction areas. See General Comment 11, below, for further explanation regarding the need to address DAPL as a source control measure and to evaluate a more expansive range of alternatives for DAPL containment/removal.

    - Lack of alternatives for pumping or treatment of the contaminated groundwater in the overburden and shallow bedrock to manage the further migration. Of the alternatives proposed by Olin, the only groundwater treatment alternative included in the FS involves well-head treatment at the Town wells and MNA (see General Comment 12, below). Olin shall evaluate a full range of remedial alternatives for containing and treating contaminated overburden and bedrock groundwater (i.e., plume extraction wells, bioremediation, etc.).

- Failure to adequately consider bedrock groundwater contamination. EPA acknowledges Olin's intent to submit a technical impracticability waiver based on back diffusion of contaminants in bedrock. However, EPA does not currently consider treatment of groundwater in the bedrock fractures to be technically impractical based on the information available. The Source Control FS Report shall contain a robust analysis of a full range of alternatives for extraction and treatment of contaminated groundwater within bedrock fractures.

- Failure to address contamination in the Aberjona Watershed. MassDEP has determined that the groundwater in the Aberjona Watershed has a high use and value. Therefore, Olin shall evaluate a full range of remedial alternatives to address contamination within the Aberjona Watershed.

- The screening of the remedial alternatives focuses solely on NDMA. All FS reports shall consider the effectiveness of the remedial alternatives on all COCs evaluated in the revised Draft OU3 RI Report. This includes contaminants which were not released from the Facility, but have been solubilized in the aquifer (e.g., arsenic) as a result of the geochemical conditions created by Site releases.

- Due to the lack of remedial alternatives considered in the Draft OU3 FS Report, the associated ARAR analysis is similarly deficient. All FS reports shall contain a detailed analysis of each remedial alternative that summarizes which requirements are applicable or relevant and appropriate (or TBC) for each alternative and describes how each alternative meets these requirements. When an ARAR will not be met, the basis for justifying one of the six ARAR waivers provided by CERCLA § 121(d)(4) shall be discussed. EPA reserves the right to provide further comments regarding the ARAR analysis completed in all FS reports.

Olin Response to Comment 10

Subsequent to the OU3 FS Olin has offered and USEPA has agreed that an IAFS will be completed that will address DAPL in the Main Street Pool and the off-Property West Ditch Pool. There are currently unresolved data gaps at the Containment Area and the on-Property DAPL pool that will be addressed concurrently with development of the IAFS. If the data gaps indicate that an Interim Action should be considered for the Containment Area, then the IAFS will appended with that information.

The IAFS will also consider alternatives to control migration of high concentrations of Site-related impacts in downgradient groundwater as discussed with USEPA during the December 10, 2018 meeting.

Olin has submitted a revised BHHRA that includes the Aberjona watershed. With the exception of residences on Cook Avenue, there are no other current groundwater receptors/users in the watershed within the boundary of impacted groundwater. In addition, other areas overlying impacted groundwater are not considered potential future groundwater source areas by definition under the MCP due to the density of commercial and industrial development and lack of moderate to high yield aquifers. Or as in the case of the Olin parcel, are subject to deed restrictions. During the December 10, 2018 meeting, the MassDEP stated that in accordance with their Comprehensive Ground Water Protection Program ("CSGWPP") that this portion of the Aberjona watershed, adjacent to the Industri-Plex Site is either designated as a non-potential drinking water source or has does not possess the characteristics of a future potential drinking water source area. Although further discussion is anticipated, the parties appear to be moving toward a common understanding of how water classification will addressed to help manage site risks.

Since NDMA is the primary risk driver for groundwater exposure, the FS focused on NDMA. There are no areas of groundwater impacted by other COPCs that fall outside the area of groundwater impacted by NDMA. Due to the nature of groundwater treatment technologies involved, treatment of NDMA must occur after other contaminants have been addressed. All of the other Olin related risk drivers are metals that are not subject to biodegradation. NDMA is potentially subject to oxidation through co-metabolic biodegradation, but this is not a proven technology at a field scale at this time. Olin has requested USEPA approval to proceed with a treatability study to evaluate NDMA cometabolism as a viable remedial alternative.

There are other sources of contamination in the aquifer for VOCs and arsenic. The Town Wells had long been treated for VOCs prior to their shutdown. Olin does not agree it needs to develop alternatives for contaminants contributed to the aquifer by other parties. This point will require further discussion with USEPA.

The ARARs analysis will be revised for the IAFS based on the revised list of remedial alternatives that will be included in the IAFS.

As stated in Response to General Comment #1, Olin will proceed with development of an IAFS.

EPA Response to Olin Response to Comment 10

As noted in EPA Response to Olin Response to Comments 1 and 7, EPA understands that the IAFS will address source control alternatives, including alternatives for removal of DAPL from the containment area. Data gaps and the CSM will continue to be evaluated through a separate Data Gaps Work Plan.

EPA will continue to work with MassDEP and Olin to evaluate how groundwater within the Aberjona watershed is classified and how the corresponding alternatives to address contamination within the aquifer are developed.

The IAFS will focus on source control alternatives. NDMA is not the only COC present at the site. The IAFS shall include treatment options for all COCs extracted as part of the source control response actions.
'

11. As stated above, Olin shall evaluate a full range of remedial alternatives for source control of the contaminated groundwater in the overburden and shallow aquifers that continue to migrate uncontrolled. In evaluating DAPL source control remedial alternatives, Olin shall consider the following:

    - The Source Control FS Report shall include a discussion of principal threat waste ("PTW") at the Site. DAPL and other media (e.g., holding basin soils and sediment) shall be included in this discussion. For any wastes determined to be PTW, Olin shall explain how the remedial alternatives proposed to address those wastes satisfy the NCP's expectation that treatment is used to address PTW wherever practicable.

    - EPA does not agree with Olin's assertion that DAPL and diffuse contaminated groundwater resulting from DAPL's presence is "stable." The basis for EPA's position is presented in EPA's July 13, 2017 Statement of Position responding to Olin's dispute. Section III.B. Contains a detailed summary of the trend analysis performed by EPA and its contractor and the conclusions of this analysis. EPA's position on this technical issue has not changed following a complete review of the Draft OU3 RI Report. The data and trend analysis do not support Olin's conclusion that the groundwater plumes are stable.

    - In the Source Control FS Report, Olin shall delete all statements that the DAPL and associated groundwater plumes are stable. Olin shall include a discussion of the trend analysis conducted by EPA as presented in Section III.B. of the July 13, 2017 Statement of Position. Furthermore, the Source Control FS Report shall include alternatives that manage the further migration of contamination in the overburden and bedrock aquifers.

    - Contrary to Olin's assertion, the DAPL Pools and the diffuse groundwater contamination resulting from ongoing diffusion present a threat of future exposure. Olin's installation of an alternative water line does not negate the need to evaluate the threat of future

exposure. The majority of the DAPL and the diffuse and overlying plumes are located off of Olin's property and extend approximately three-quarters of a mile to the west-northwest, located under many homes and active businesses. It is possible that private owners could be exposed to DAPL, the diffuse plumes and other contaminated groundwater. The lifetime risk for a person consuming either DAPL or overlying diffuse groundwater resulting from the presence of the DAPL pools would exceed the upper end of EPA's acceptable risk range. In the Source Control FS Report, Olin shall include a robust discussion of the threat of future exposure to Site-related contamination and include appropriate RAOs to address these threats.

- MassDEP has determined that the Site aquifer has a high use and value, and the Town of Wilmington has expressed a desire for restoration of the drinking water aquifer. EPA policy dictates that remediation programs should defer to state determinations of current and future groundwater uses, when based on an EPA-endorsed Comprehensive Ground Water Protection Program ("CSGWPP") that has provisions for site-specific decisions. The Commonwealth of Massachusetts has a core CSGWPP endorsed by EPA and routinely uses Groundwater Use and Value determinations for CERCLA sites located in Massachusetts. EPA must evaluate actions to restore and protect this aquifer consistent with the Commonwealth's designation of high use and value. A principal component of aquifer restoration will necessarily involve source control.

Olin Response to Comment 11

The general approach to developing FSs has moved forward in a positive manner in discussions between Olin and USEPA. The text in the IAFS will include a discussion regarding principal threat wastes, and how these wastes will be addressed by the remedial alternatives.

Olin has agreed to develop a work plan for additional comprehensive groundwater sampling to evaluate current groundwater conditions and to provide a data set to compare changes to the comprehensive 2010/2011 data set.

Olin and USEPA have discussed each side's differing view of the term stable and have agreed to develop alternate terminology that can be agreed upon by both parties.

EPA Response to Olin Response to Comment 11

EPA acknowledges Olin's response.

12. Olin's recommended alternatives rely on monitored natural attenuation ("MNA") as the principal component of the remedy. Olin has not presented any evidence (groundwater trends, statistics, plume maps, etc.) that MNA is occurring.

    Additionally, alternative 2, part of Olin's recommended alternatives, uses MNA as a principal component of the remedy without attempting source control, as required by EPA's MNA guidance (https://semspub.epa.gov/src/document/HQ/159152). The guidance states, in part:

- "Sources of contamination are more appropriately addressed by engineered removal, treatment or containment technologies";

- "Source control measures should be evaluated as part of the remedy decision process at all sites, particularly where MNA is under consideration as the remedy or as part of the remedy component"; and

- "EPA, therefore, expects that source control measures will be evaluated for all contaminated sites and that source control measures will be taken at most sites where practicable."

In the Further Groundwater FS Report, Olin shall provide a robust discussion of the efficacy of MNA on the groundwater plume. Any alternatives which propose MNA shall have source control as a principal component of the alternative.

Olin Response to Comment 12

The scope of the Feasibility Studies has evolved during and subsequent to the December 10, 2018 meeting as discussed previously. The IAFS should address all of the concerns stated above since it will address the major DAPL sources and downgradient migration of contaminated groundwater.

EPA Response to Olin Response to Comment 12

EPA acknowledges Olin's response. Should MNA be a part of the proposed remedy in future OU3 remedial alternatives, EPA will evaluate the proposal at that time.

13. There are statements throughout the Draft OU3 FS Report which purport EPA approval of certain findings and conclusions. Some of these statements are not supported by the record. To the extent such statements are made in all FS reports, they shall only be included if a source reference can be provided (i.e., cite an EPA approval letter).

Olin Response to Comment 13

Olin concurs with this request. The text will be revised for the IAFS to include specific references to USEPA approval letters where appropriate.

EPA Response to Olin Response to Comment 13

EPA acknowledges Olin's response.

SPECIFIC COMMENTS

1. Page 1-1, Section 1.0 – Olin states: "A Draft Remedial Investigation (RI) Report has been developed by Olin Corporation (Olin) for Operable Unit 3 (OU3) at the Olin Chemical Superfund Site (OCSS) in

Wilmington, MA. The RI Report has been prepared simultaneously with this OU3 Feasibility Study (FS) Report on March 30, 2018 at the request of the United States Environmental Protection Agency (USEPA)." See Appendix 1, General Comment 6, and Appendix 6, General Comment 1, explaining how the FS Reports shall be combined and developed.

Olin Response to Comment 1

Olin will prepare an IAFS and a Further Groundwater FS as requested by the USEPA.

EPA Response to Olin Response to Specific Comment 1

Acknowledged; see EPA Response to Olin Response to Comment 1 above.

2. Page 1-3, Section 1.2, final paragraph – Olin shall modify this paragraph to note that the Town of Wilmington continues to maintain the water supply wells with the intent of re-activating them in the future.

Olin Response to Comment 2

Olin will add clarification of the Town of Wilmington's position regarding the water supply wells and requests USEPA provide documentation of the Town's position so that it may accurately be portrayed.

EPA Response to Olin Response to Specific Comment 2

Acknowledged; EPA will provide documentation of the Town's position.

3. Page 1-5, Section 1.3 – Olin states: "Olin completed closure of the Lined Lagoons as part of the closure activities initiated in 1986 (MACTEC, 2007) and completed in accordance with closure plans approved by MassDEP." Olin shall provide documentation of this approval and a discussion of any residual soil contamination.

Olin Response to Comment 3

Olin will add documentation and discussion as requested.

EPA Response to Olin Response to Specific Comment 3

Acknowledged.

4. Page 1-5, Section 1.3 – Olin states: "The alignment borings were initial targets for depth to bedrock; however, where weathered bedrock was encountered at excavation, several additional feet of bedrock were typically excavated to ensure the slurry wall connected to more competent bedrock." This statement directly contradicts Olin's claim of competent bedrock beneath the Containment Area. Olin

shall provide a more in-depth description of the bedrock material encountered during slurry wall construction, as well as copies of any reports discussing the construction of the slurry wall.

Olin Response to Comment 4

Olin will provide a more in-depth discussion including reports discussing the slurry wall construction. These reports have been provided to USEPA in the past and Olin will provide them again. To be clear, having a rind of weathered bedrock above competent bedrock does not affect the ability of that competent bedrock to impart a barrier to DAPL migration any more than having a transmissive sand and gravel unit overlying the bedrock. The elevation of competent bedrock is still well above the elevation of DAPL.

EPA Response to Olin Response to Specific Comment 4

Acknowledged; EPA will review the revised discussion regarding slurry wall construction.

5. Page 1-6, Section 1.3 – Regarding the bulleted list concerning the effectiveness of the Containment Area, see Appendix 2. Olin shall revise accordingly.

Olin Response to Comment 5

Please see response to Appendix 2 comments.

EPA Response to Olin Response to Specific Comment 5

See EPA's responses to Olin's comments in Appendix 2.

6. Page 1-6, Section 1.3, bullet 2 – The SASRs do not provide water level information for deep overburden or bedrock monitoring points within the containment cell; therefore, the vertical gradient cannot be calculated from those reports. EPA is aware of only one set of paired deep/shallow water levels measured in 2016 (not included in the Draft OU3 RI Report). Olin shall revise this statement accordingly.

Olin Response to Comment 6

Data will be provided to support the statement made regarding the vertical gradients inside the Containment Area. Note there are no screened bedrock wells within the Containment Area. One of the early observations made in reporting after construction of the Containment Areas was that vertical gradient became more subdued (less pronounced) between shallow and deep pairs.

EPA Response to Olin Response to Specific Comment 6

Acknowledged; EPA will review the data provided by Olin.

7. Section 1.4 – Olin shall revise this section of the Report in accordance with EPA's comments on the Draft OU3 RI Report.

Olin Response to Comment 7

Please see responses to Appendix 2 comments. Olin and USEPA have differing opinions as to the Containment Area CSM. This will result in additional investigations to address data gaps. The IAFS will be appended if necessary to address the containment area should closure of data gaps indicate that interim action is necessary in this location.

EPA Response to Olin Response to Specific Comment 7

See EPA's responses to Olin's comments in Appendix 2. Regarding the IAFS, Olin has agreed to submit an IAFS addressing source control alternatives by April 11, 2019. Data gaps and disagreements regarding the CSM will be addressed through a separate Data Gaps Work Plan. See EPA Response to Olin Response to General Comment 1 above.

8. Page 1-7, Section 1.4.1 – Olin states: "Potable use of groundwater does not pose an unacceptable risk at the residential wells evaluated." This statement shall be revisited following EPA's approval of the revised risk assessment for these wells which considers an NDMA inhalation factor.

Olin Response to Comment 8

The revised risk assessment came to a similar conclusion. The revised language from that assessment will be included in the revised FS.

EPA Response to Olin Response to Specific Comment 8

As noted in a previous EPA response, EPA does not agree that providing bottled water indefinitely until the final groundwater remedy is selected is an acceptable response to those residence with NDMA detected in their wells. The IAFS shall include alternatives that address this issue and not post-pone such an evaluation until the final remedy for groundwater is determined.

9. Page 1-8, Section 1.4.1 – Olin states: "Other risk contributors that are not associated with the releases from the OCSS include 1,2-dichloroethane (1,2-DCA), benzene, cis-1,2-dichloroethene (cis-1,2-DCE), naphthalene, trichloroethene (TCE), and vinyl chloride (VC)." Olin shall provide documentation explaining why these commonly used chemicals would not have been used or present as contaminants at the Facility.

Olin Response to Comment 9

Olin will provide a discussion of the releases documented by MADEP that account for these other contaminants. In addition the groundwater distribution figures clearly show the former Sanmina facility to be a source of cVOCs (1,2 DCA and TCE), rather than Olin. Note the former Sanmina facility overlies the area of the groundwater divide and Olin seasonally is downgradient of Sanmina as indicated by sporadic detection of lower concentrations of 1,2 DCA. There was no reported use of chlorinated solvents at the

Olin facility. The distribution figures bear this out. The Whitney Barrel Company which cleaned and recycled spent 55 gallon drums is a source of chlorinated benzene compounds and other VOCs in adjacent groundwater.

EPA Response to Olin Response to Specific Comment 9

EPA will review the discussion provided by Olin. EPA notes that review of the 1-2-DCA plume map developed by EPA's contractor Nobis indicates that the highest concentrations are associated with the DAPL pools, including the GW-83 cluster and the main Street DAPL pool. Concentrations ten times greater than the tapwater RSL were detected within the containment area, which Olin has argued is hydraulically isolated from other groundwater. Chloroform follows a similar pattern to 1,2-DCA. Based on this, it is likely Olin will need to provide analysis of the pattern of VOCs on a per-VOC basis.

10. Page 1-8, Section 1.4.2 – Olin states: "Groundwater impacts in the MMB aquifer are primarily deep, occurring in the deep overburden and underlying bedrock." This statement is misleading and shall be revised or removed from all FS reports. While concentrations of NDMA and other contaminants of concern are generally higher deeper in the overburden, NDMA concentrations are high (relative to the tap water RSL) in most of the overburden. Olin shall provide additional figures that indicate the extent of vertical contamination, addressing the larger plume of NDMA that extends well above the limits of DAPL and the "diffuse layer" as defined by Olin.

Olin Response to Comment 10

Olin will provide additional figures indicating the extent of vertical contamination including vertical cross-sections within the MMBA and will provide a more robust discussion of the conclusions the data support. Olin does not believe its statements were misleading. The highest concentrations of NDMA are deep within the MMB aquifer associated with diffuse groundwater. This defines the plume core in accordance with USEPA Risk Assessment Guidance and is the exposure point evaluated by the BHHRA.

EPA Response to Olin Response to Specific Comment 10

EPA will review the additional figures and discussion.

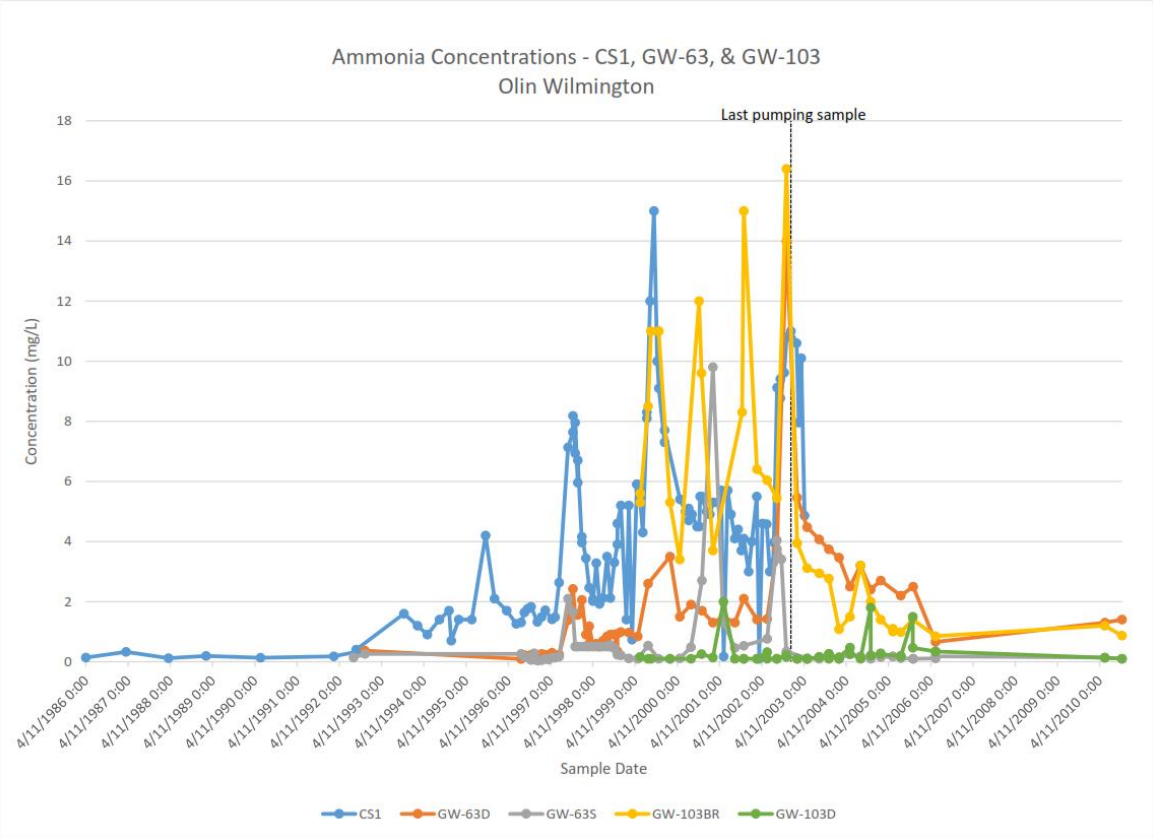
11. Page 1-8, Section 1.4.2 – EPA does not agree that the evidence provided in the Draft OU3 RI Report or Draft OU3 FS Report clearly indicates pumping of the overburden wells would pull in contamination from bedrock. Specifically:

    a. 1st bullet – The contaminant concentrations around the wells closest to the Chestnut Street pumping wells (GW-103D, GW-103BR, GW-63D, and GW-63S) do not appear to indicate a clear trend.
    b. 2nd bullet – Detected NDMA concentrations are very limited at wells closest to the Chestnut Street pumping wells (GW-103D, GW-103BR, GW-63D, and GW-63S), as only three or four data points are available and there is a significant data gap prior to the RI sampling.

Olin Response to Comment 11

Hydrogeologic principal and theory clearly indicate that by imposing a large drawdown in an overburden aquifer that is clearly well connected to the underlying bedrock aquifer, that the resulting upward vertical gradient will cause upward movement of groundwater from bedrock to overburden. If the MMB overburden and bedrock aquifers were not well connected (i.e., were isolated) there would not be the level and extent of contamination currently observed in bedrock. Since cessation of pumping overburden groundwater located between the Town Wells and the core of the overburden plume have been flushed by clean upgradient groundwater moving down the MMB buried valley.

Though historical data is limited concerning the effects of overburden groundwater extraction on bedrock groundwater, data from GW-103BR clearly shows a sharp reduction in constituent concentrations immediately following cessation of Town Well pumping indicating it was affected by operation of the Town Wells. This well has years of data during the period when the Town Wells were active. The following graph depicts municipal well Chestnut Street-1 (CS1) ammonia data (blue) from 1986 to when it was finally shut down (last pumping sample in 2003). From 1999 to 2010, this graph also shows ammonia



concentrations in GW-103BR (yellow) the bedrock well located behind (to west side of) CS1. Note that the concentrations in GW-103D (green) in deep overburden also located on the west side of CS1 are essentially unaffected by CS1 operation. However the ammonia concentrations in GW-103BR are nearly identical to or higher than those in CS1 while CS1 was operated. This indicates bedrock is being affected by Town well pumping of the overburden aquifer and that bedrock is likely an important component of the source of dissolved constituents to the town well. Once CS1 pumping stops the ammonia concentrations in bedrock well GW-103BR decline rapidly over the next 3-4 years. Clearly the deep

overburden well GW-63D (orange) is also responding to CS1 pumping in a like manner. The sulfate data is very similar for these wells except that the sulfate concentrations are more similar in GW-63D and GW-103BR and both are substantially higher than in CS1. These data indicate that pumping of the town wells induces flow in bedrock up into overburden. Bedrock may also have been the source of higher constituent concentrations in GW-63D when CS-1 was being operated.

Olin believes it is giving this data appropriate weight and an objective interpretation with respect to its implication that restoration of the overburden aquifer will not result in un-restricted use of the MMB groundwater aquifer without treatment. Olin is merely trying to inform USEPA and stakeholders that future operation of the Town Wells will inevitably require treatment since treatment of the underlying fractured bedrock is unlikely to be technically practicable or even remotely feasible. Through scientific literature and decades of experience in fractured bedrock, it is a common understanding that matrix diffusion will result in extremely long time frames (many decades to hundreds of years) where low to moderate concentrations of contaminants will persist as a long term source that cannot be removed by conventional pump and treat technologies regardless of the other many complexities to be overcome in bedrock.

Olin is concerned that if USEPA fails to recognize what appears to be an obvious and important relationship between bedrock groundwater and historical Town Well impacts, then the USEPA team will be relying on a CSM that lacks a very important and fundamental conceptual understanding of the Site. Therefore Olin will endeavor to explain these relationships more thoroughly in the revised RI and FSs acknowledging that the data in that important historical time frame shown in the above graph is regrettably limited.

EPA Response to Olin Response to Specific Comment 11

EPA acknowledges Olin's concern and will review the revised discussions, providing further comments to Olin at that time.

12. Page 1-11, Section 1.4.2 – Olin's claims regarding greywater acting as a source of NDMA requires significant further evaluation. The cursory dismissal of the possibility that NDMA contamination found in these residential wells may be Site-related is unacceptable. If the presence of NDMA at these wells does not fit the conceptual site model, then the conceptual site model may need to be re-evaluated. Olin shall expound upon this section of the report significantly in the revised Draft OU3 RI Report and all FS reports.

Olin Response to Comment 12

We agree the CSM should be re-evaluated in cases such as these. And will expound upon this section as requested. Olin believes that the potential for a domestic source of NDMA should be incorporated as part of the CSM where residences are on septic systems and is not simply dismissing impacts at the Site as unrelated. However given the geographic distribution of these low intermittent detections of NDMA and their location far upgradient from the MMBA and Site, it becomes problematic to identify realistic groundwater pathways to explain these remote and intermittent detections. While these low level NDMA detections do not present an unacceptable risk based upon the BHHRA, it is very conceivable domestic sources could play a role in their presence in the environment at low concentrations.

As with other emerging contaminants (such as PFAS) as more research is developed society is being confronted with the discovery of a wider range of anthropogenic contaminants in household and consumer products. Apparently based on the research referenced by Dr. William Mitch, a nationally recognized NDMA authority, NDMA is in our households (Zeng and Mitch, 2015). If USEPA believes that this issue warrants further evaluation we welcome the opportunity for discussion.

If unacceptable risk is found to be posed by NDMA in the residential wells, Olin will implement alternatives developed in the Response Alternatives Evaluation (RAE) Report conditionally approved by USEPA on June 20, 2012. (See also response to Specific Comment 8).

EPA Response to Olin Response to Specific Comment 12

EPA will review Olin's expanded discussion of this issue in the revised reports. EPA notes this issue shall not delay the submittal of the IAFS. EPA also notes that for the two homes where bottle water is provided, a more effective solution needs to be implemented and this solution should not be delayed until the final remedy for groundwater is selected.

13. Pages 1-14 and 1-15, Section 1.4.5 – Olin shall add a discussion of the effects of the pumping of the Town wells on the watershed divide, and on the shallow bedrock network.

Olin Response to Comment 13

Olin will add the discussion as requested. Olin has stated previously that it does not believe pumping of the Town wells had any demonstrable effect on the location of the Ipswich - Aberjona Watershed divide. Note that the Sanmina wells which are located on the divide were also being pumped during the same time frame at combined rates that averaged up to 160,000 gallons per day (in excess of 100 gpm). The effects of Sanmina pumping on the divide would have obliterated any hydraulic evidence of a combined influence from the town wells.

Olin has stated its position that the effects of town well pumping are most relevant to bedrock closer to the town wells in areas underlying MMB. It is unlikely that there is evidence of demonstrable effects in monitoring data from that time frame near the divide. Any discussion of effects on town well pumping on shallow bedrock groundwater near the divide would be pure speculation and not useful.

EPA Response to Olin Response to Specific Comment 13

EPA will review the discussion provided by Olin. The discussion shall analyze the effects of pumping of both the Town and Sanmina wells. EPA notes this issue shall not delay the submittal of the IAFS.

14. Section 1.5 – Olin shall revise this section in accordance with EPA's comments on the OU3 Draft RI Report.

Olin Response to Comment 14

See response to comments on Section 1.5 of the RI report.

EPA Response to Olin Response to Specific Comment 14

See EPA's responses to Olin's comments on the RI report.

15. Page 1-17, Section 1.5.2 – Olin states: "Based on existing conditions, groundwater use restrictions, and the nature of DAPL…there is no current or foreseeable receptor for DAPL exposure." This approach is not consistent with EPA guidance as it fails to appropriately characterize the possible risks. Olin shall revise in accordance with comments on the Draft OU3 RI Report.

Olin Response to Comment 15

Olin shall revise the discussion in accordance with the revised BHHRA submitted in December 2018 which contained the following language concerning Potential future receptors and exposure pathways that were evaluated in the risk assessment:

Off-Property residents who might hypothetically use the residual waste material DAPL for long-term potable use. This exposure scenario is exceedingly improbable. Note: In this hypothetical scenario, a resident might be exposed to DAPL via ingestion (drinking water and cooking), dermal contact during bathing and showering, and inhalation of volatiles released to bathroom air during bathing or showering. The DAPL is dark green to black in color and long-term potable use of this waste material is improbable.

The December 2018 BBHRA provide the following conclusions and uncertainties about hypothetical consumption of DAPL.

Conclusion

- *Calculated cancer risk for the hypothetical future exposure scenario is above the upper end of the NCP and USEPA cancer risk range, the calculated non-cancer HI is above the CERCLA limit of 1, and the estimated blood lead levels for a child are below the USEPA target blood lead level of 10 µg/dL and the CDC "reference level" of 5 µg/dL for:*
  - *Hypothetical potable use of DAPL residual waste material.*

Uncertainties

Although potable use of DAPL has been evaluated as a hypothetical scenario, DAPL is not groundwater, but rather a waste material associated with past plant operations. The pumping and long-term ingestion of DAPL is considered an extraordinarily improbable scenario. The DAPL is green/black in color, which would be a signal to any responsible person that it is not suitable for drinking (see photograph in Attachment F of the December 2018 revised BHHRA). *In addition, the DAPL has low pH (well below the Secondary MCL (USEPA, 2018e) of 6.5-8.5) and high dissolved solids (orders of magnitude above the Secondary MCL of 500 mg/L) including sulfate and chloride at concentrations orders of magnitude above the Secondary MCL of 250 mg/L for both, which would result in unpalatable taste*

EPA Response to Olin Response to Specific Comment 15

EPA will provide comments on the BHHRA in a separate letter. EPA will review Olin's revised discussion in the FS Reports.

16. Page 1-18, Section 1.5.3 – Olin states: "Based on its physical characteristics alone, it is unreasonable to expect that consumption of DAPL is a reasonably foreseeable exposure scenario. Therefore, there is no foreseeable physical exposure to DAPL that would potentially cause an unacceptable risk." EPA disagrees with this statement, as explained in comments on the Draft OU3 RI Report. Olin shall delete these statements from the Source Control FS Report.

Olin Response to Comment 16

Olin shall revise language in IAFS consistent with the revised BHHRA submitted in December 2018. Please see response to Comment 15 above.

EPA Response to Olin Response to Specific Comment 16

EPA will provide comments on the BHHRA in a separate letter. EPA will review Olin's revised discussion in the IAFS.

17. Page 1-18, Section 1.5.3 – Olin shall provide figures (plans and profiles) for all contaminants listed below to define the extent of contamination in the revised Draft OU3 RI Report and all FS reports:

    a. Core of the Ipswich overburden plume: NDMA, biphenyl, chloroform, antimony, arsenic, cobalt, iron, manganese, nickel, and vanadium.
    b. Core of the Ipswich bedrock plume: NDMA, 2,4,4-Trimethyl-1-pentene, chloroform, hydrazine, antimony, arsenic, cobalt, iron, manganese, nickel, and vanadium.

Olin Response to Comment 17

Olin will provide contoured figures as requested in the revised OU3 RI Report and the related FS reports

EPA Response to Olin Response to Specific Comment 17

Acknowledged.

18. Page 1-20, Section 1.5.3 – Olin states: "The configuration and nature of this impact is a technical barrier to aquifer restoration, including the overburden in the MMB aquifer. Extraction of groundwater from the overburden aquifer will result in vertical contribution of underlying impacted bedrock groundwater." Olin has not presented any evidence to support this claim beyond theoretical modeling. These statements cannot be made with confidence and shall be modified to express the uncertainty or removed from all FS reports.

Olin Response to Comment 18

Please see response to Comment 11. This is an extremely important component of the CSM that Olin and USEPA will need to devote considerable attention to resolving. Resolution will require eventual USEPA approval of a work plan and execution of studies to quantify matrix diffusion. Olin prepared the conceptual numerical model to alert USEPA to the potential importance of this issue. Olin will hold

further discussion related to bedrock matrix diffusion in abeyance until a more appropriate time (i.e., once the IAFS has been developed and appropriate data gaps have been identified and methodology to be used to close said gaps is developed and approved).

EPA Response to Olin Response to Specific Comment 18

See EPA Response to Olin Response to Specific Comment 11. EPA agrees with Olin's plan to hold further discussion of this issue in abeyance until the IAFS has been developed and the Data Gaps Work Plan has been approved.

19. Section 1.6 – Olin shall revise this section in accordance with EPA's comments on the Draft OU3 RI Report.

    Page 1-21, Section 1.6 – Olin states: "Although there is no reasonably foreseeable exposure to DAPL, the FS should address migration of dissolved constituents in the Ipswich watershed associated with DAPL and DAPL as an ongoing source of those constituents." EPA disagrees there is no reasonably foreseeable exposure to DAPL, as explained in comments on the Draft OU3 RI Report. Olin shall revise accordingly.

Olin Response to Comment 19

Please see responses to Comments 15 and 16.

Olin has agreed to develop an Interim Action FS to address DAPL and ongoing migration of impacted groundwater in the Ipswich watershed.

EPA Response to Olin Response to Specific Comment 19

See EPA Responses to Olin's Responses to Specific Comments 15 and 16.

20. Page 1-21, Section 1.6 – As discussed in EPA's comments on the Draft OU3 RI Report, the following conclusions from the Draft OU3 RI Report are inaccurate and or unsupported:

    a. "Bedrock underlying the DAPL pools and bedrock within the WBV under the region of diffuse groundwater have had long term impacts from high concentrations of NDMA. These areas are believed to contain a mass retained by matrix diffusion that is significant enough to render treatment of bedrock groundwater by extraction and treatment technically infeasible." Olin has not provided sufficient evidence to support this claim and shall revise or remove the statement from the all FS reports.
    b. "Future use of the Town wells will induce an upward vertical gradient from underlying bedrock groundwater to deep overburden groundwater and therefore restoration of the MMB overburden aquifer to potable quality is not feasible in the foreseeable future." Olin has provided no evidence that operation of the Town wells would render restoration of the aquifer infeasible when the application of remedial technologies is

considered. Olin shall revise or remove this statement from the all FS reports.

c. "DAPL extraction will not remove all DAPL. As extraction progresses, DAPL naturally becomes less dense and less concentrated as the top of the pool is drawn downward. This will limit the effectiveness of DAPL extraction by gravity drainage in the long run. Olin shall develop and evaluate remedial alternatives which will address this predicted problem.

d. "Extraction of DAPL will not result in attainment of groundwater restoration goals within a meaningful time frame." This statement is unsupported. Olin shall provide additional supporting evidence for this claim or revise or remove the statement from the all FS reports. Remedial alternatives which combine both DAPL extraction and other treatment technologies should work to address groundwater restoration within a reasonable timeframe. Also note the general comments above regarding revised RAOs for DAPL and groundwater.

Olin Response to Comment 20

See responses to comments on the Draft OU3 RI report. Changes made to the conclusions of the Draft OU3 RI Report will be translated to the FS Reports.

Olin disagrees that its conclusions are inaccurate or unsupported. Conclusions may be supported by site specific information or published literature including computational models. In this case Olin's conclusions are supported by a combination of both. The history of Pump & Treat as a remedial technology has clearly shown its inability to restore aquifers affected by matrix diffusion particularly in porous fractured media, fractured media and porous media with low permeability zones. At best Pump & Treat can be effective containing sources under the right hydrologic conditions. Olin will temper its stated belief in the FS documents by adding sections detailing the high level of uncertainty such remedial approaches have in actually restoring an aquifer with impacts of the magnitude at this site.

With respect to point "a" and "d" Olin's initial conceptual numerical modeling of the effects of matrix diffusion support the long-expected time frames consistent with other sites that have undergone more rigorous evaluation of the long-term effects of matrix diffusion. In response to USEPA's request for physical proof of matrix diffusion, Olin submitted a matrix diffusion sampling work plan which EPA has rejected even after several long conference calls that appeared to resolve the major technical issues. These issues will not be resolved until such work plans are eventually approved and work is completed.

Please see response to comment 11 for bullet "b".

With regard to bullet "c" Olin will develop and evaluate remedial alternatives which will address the referenced issue.

EPA Response to Olin Response to Specific Comment 20

See EPA's responses to Olin's comments on the OU3 RI. EPA will review the revisions described by Olin and continue to work with Olin to develop a work plan to address the effects of matrix diffusion. EPA notes that while EPA and Olin had extensive discussions regarding the work plan and the particulars of the sampling method were generally approved, EPA did not consider the proposed locations to be well

located and in sufficient in number to answer the question of matrix diffusion. This issue shall not delay the submittal of the IAFS.

21. Page 2-1, Section 2.1 – See General Comment 3, above, regarding revisions to the RAOs.

Olin Response to Comment 21

Olin developed the RAOs based on discussions with EPA in February of 2018. Olin requests further discussion on the RAOs.

EPA Response to Olin Response to Specific Comment 21

See EPA response to Olin's Response to General Comment 3.

22. Section 2.1.4 – This section shall include the volumes of contaminated groundwater for each contaminant of concern. Note that these volumes may be different for each contaminant, and therefore this information may be better presented in a table. Olin shall revise accordingly.

Olin Response to Comment 22

Olin will provide *estimated* volumes of contaminated groundwater as requested for the full extent of the plume. Olin does not believe estimation of the volume of impacted groundwater for each individual COC has any merit or adds benefit to the FS.

EPA Response to Olin Response to Specific Comment 22

Estimation of volume for every COC among groups of COCs which have similar contaminant profiles and general location/extent may not be required. However, there is still benefit to providing estimates for volumes of water that may require additional or separate treatment (e.g., volume of total plume vs. volume of plume with high concentrations of other constituents that may complicate treatment, such as metals and anions). Olin shall revise the FS reports accordingly.

23. Page 2-5, Section 2.2 – Olin mentions volume minimization/concentration of DAPL in Table 2.3-1. Such evaporation process is considered treatment; therefore, Olin shall add "treatment" to the list of general response actions for DAPL.

Olin Response to Comment 23

Olin will add "treatment" to the list of GRAs as requested. EPA should understand this is a process option for reduction of quantity of material requiring disposal.

EPA Response to Olin Response to Specific Comment 23

Acknowledged.

24. Section 2.3.2 – Olin shall include treatment alternatives for all the COCs, not just NDMA. At a minimum, Olin shall include available technologies based on UV irradiation (including UV and pulsed-UV/hydrogen peroxide), adsorption technologies (including GAC and zeolites), and biological methods (including fluidized bed bioreactor, propane biosparging).

Olin Response to Comment 24

Olin will provide costing for technologies that are retained for further evaluation in the Further Groundwater FS for COPCs for the point at which treatment is applied. In treatment of groundwater for NDMA, the removal of other contaminants and constituents that would adversely affect UV light penetration is required prior to UV treatment or UV oxidation. Currently the Butters Row Treatment Plant treats for VOCs and other constituents and therefore in alternatives where Town Wells are placed into service with treatment, additional treatment for NDMA need only be considered.

EPA Response to Olin Response to Specific Comment 24

Acknowledged.

25. Section 3.0 – Olin asserts repeatedly that it is important to limit DAPL-diffuse layer mixing and interactions. Technical information to support such assertions are limited, and the assertions appear to be speculative (i.e., mixing would lead to significant mineralization and soil clogging). Sufficient information has not been provided to support that this technical consideration should be weighted so heavily in the evaluation of remedial alternatives. Olin shall provide an expanded discussion of this concern and revise remedial alternatives accordingly.

Olin Response to Comment 25

Olin will provide an expanded explanation concerning this issue and reference site data, as well as the column studies for simulating DAPL extraction that were performed previously. DAPL contains percent levels of sulfate and high concentrations of iron and chromium all of which are geochemically susceptible to precipitation when redox and pH (eH and pH) conditions change due to intrusion of overlying groundwater into the DAPL-diffuse interface. For this reason, excessive intrusion of overlying water which would change geochemical conditions should be avoided. Further, in a deeper, larger pool of DAPL excessive steep drawdown of the DAPL in vicinity of the extraction well could cause the denser DAPL to "tumble" into that fluid density depression with resultant convective mixing and precipitation of acid sulfates and other related minerals in the soil pores. The caution is placed not on implementing the technology of DAPL extraction, but rather how it is implemented to avoid these potential operational problems.

EPA Response to Olin Response to Specific Comment 25

Acknowledged; EPA will review the expanded explanation.

26. Page 3-3, Section 3.2 – The RAOs shall be revised in accordance with General Comment 3, above.

Olin Response to Comment 26

Please see response to General Comment 3

EPA Response to Olin Response to Specific Comment 26

See EPA's response to Olin's Response to General Comment 3.

27. Page 3-3, Section 3.2 – The list of alternatives is poorly developed. It fails to consider DAPL extraction from all DAPL areas. It fails to propose groundwater treatment across the Site beyond extraction through the MWSWs, which is inadequate. Only one alternative (alternative three) addresses non-DAPL contamination, and inadequately so. The FS has no provisions for addressing NDMA contamination that extends to the southeast of the Site in overburden and bedrock. Groundwater contaminated by the Olin property has migrated a significant distance to the southeast and has the potential to impact drinking water and sensitive ecological receptors to the southeast. It is irrelevant that Halls Brook holding area may be contaminated in part by another PRP; the Site includes Olin's property and wherever contaminants have migrated. Olin shall propose additional alternatives addressing these omissions, and carry an analysis of the alternatives through all FS reports. See also General Comment 11, above.

Olin Response to Comment 27

Olin and USEPA have agreed to proceed with an IAFS to address DAPL and downgradient groundwater migration in groundwater in the Ipswich watershed.

As discussed in the December 10, 2018 meeting, off-site migration of impacted groundwater in the Aberjona watershed to the southeast is very limited and is "not over an extensive distance" as suggested in the comment above. In the December 10 meeting it was acknowledged that development of the BHRRA for the Aberjona watershed did not preclude an LTM approach to long term management of Site risks. Once the December 18, 2018 revised BHHRA has been reviewed Olin proposes additional discussion with EPA in consultation with MassDEP on RAOs for the Aberjona watershed with consideration of MCP regulations and guidance.

EPA Response to Olin Response to Specific Comment 27

See EPA responses to Olin Responses to General Comments 3 and 10 above.

28. Page 3-5, Section 3.2.6 – In regard to the Cook Avenue wells consumption risk, Olin states: "However, whether risks will become apparent in the future cannot be predicted." This statement illustrates why alternative 4 is unacceptable. It would not be protective of human health given the dynamic nature of NDMA concentrations observed in the wells.

Section 4.2 – Olin provides no justification for why DAPL from only the Off-PWD DAPL Pool would be extracted. Olin shall provide further explanation within this alternative, and also develop additional alternatives in which DAPL is extracted from all known DAPL areas (see General Comment 11, above).

Olin Response to Comment 28

Future concentrations cannot be predicted as they are apparently dependent on the frequency of well use and local hydrologic conditions such as precipitation. Monitoring is protective (Need to review in detail Alt 4) and the possibility of future risk will be discussed and addressed in the alternatives.

EPA Response to Olin Response to Specific Comment 28

The issue regarding alternative 4 shall be further discussed in the future groundwater FS.

As this comment relates to DAPL extraction, DAPL extraction alternatives shall be evaluated in the IAFS to be submitted by Olin by April 11, 2019.

29. Additionally, alternative 2 proposes using MNA as a principal component without attempting source control, as required by EPA's MNA guidance. See General Comment 13, above. Olin shall revise accordingly.

Olin Response to Comment 29

The IAFS will address DAPL source control.

The commenter's reference to General Comment #13 is incorrect. General Comment #12 is related to MNA and associated source control measures. Please also see response to General Comment #12.

EPA Response to Olin Response to Specific Comment 29

See EPA Response to Olin Response to General Comment 12 above.

30. Page 4-6, Section 4.2.5 – Olin states: "The time necessary to meet RAOs is likely on the order of thousands of years given the slow back-diffusion from the bedrock matrix." Olin fails to note here that leaving the DAPL pools, and DAPL in bedrock fractures, in place would result in many years of continued diffusion into the bedrock matrix, long before the reverse diffusion process would even begin. Olin shall modify this statement to make this point clear. Additionally, the EPA MNA Guidance (see General Comment 13, above) states that "MNA will be an appropriate remediation method only where its use will be protective of human health and the environment and it will be capable of achieving site-specific remediation objectives within a timeframe that is reasonable compared to other alternatives." Removing DAPL as a source control measure would likely decrease the timeframe

to meet RAOs by hundreds if not thousands of years; therefore, MNA without attempted removal of all DAPL is not an appropriate remedy.

Olin Response to Comment 30

The IAFS will address DAPL source control.

EPA Response to Olin Response to Specific Comment 30

Acknowledged.

31. Page 4-6, Section 4.2.6 – Olin states: "This alternative reduces mobility and volume of COCs in DAPL through extraction and disposal." Olin fails to explain here that DAPL would only be extracted from the Off-PWD DAPL Pool, a small fraction of the DAPL present in the overburden and shallow bedrock at the Site. Olin shall modify this statement to make this point clear, in addition to developing alternatives in which all DAPL is extracted to the extent practicable, as discussed in General Comment 11, above.

Olin Response to Comment 31

The IAFS will address DAPL source control.

EPA Response to Olin Response to Specific Comment 31

Acknowledged.

32. Page 4-8, Section 4.3.6 – Olin states: "This alternative reduces the toxicity, and volume of contaminated groundwater through extraction and treatment. In addition, operation of the MWSWs will likely result in control of the groundwater plume, reducing mobility. Toxicity, mobility, and volume of DAPL are reduced via extraction to extent practicable." There are multiple inconsistencies in this statement. First, the treatment system added to the Town Wells would only address NDMA, not the other Site-related contaminants in groundwater. Second, it is unclear how the re-activation of the Town Wells would affect the stability of the groundwaterplume and mobility of contaminants. Olin has not presented any data or modeling showing how the pumping of these wells would affect the plume. Additionally, this statement does not clarify that under this alternative, DAPL would only be extracted from the Off-PWD DAPL Pool. Olin shall modify this statement accordingly, and provide further explanation/modeling describing the effect of the Town Wells operation on the COCs.

Olin Response to Comment 32

The Butters Row Treatment Plant (BRTP) already treats for VOCs which have impacted the aquifer for decades from other sources and provided a water quality suitable for public consumption for other constituents. It is Olin's belief that treatment for NDMA can be successfully added to the end of the BRTP.

Historical operation of the MMB well field of five wells, including the two Butters Row Well and two Chestnut Street Wells prevented migration of NDMA (the most mobile constituent) to the Town Park Well, which is the fifth and most downgradient well and nearby monitoring well GW-78S/D. The operational monitoring data provides the strongest line of evidence that resumption of the Town wells with additional treatment for NDMA would curtail downgradient migration of the plume. A comprehensive finite element groundwater flow and transport model for the Site has only been created for overburden and was presented in the Draft Focused RI.

EPA Response to Olin Response to Specific Comment 32

Olin shall provide further explanation detailing the position that only NDMA treatment would be required at the end of the BRTP. Olin shall provide the operational monitoring data and groundwater fate and transport model originally presented in the FRI in the revised OU3 groundwater RI. EPA notes that NDMA monitoring using low detection limits (less than 10,000 ng/L) was limited to one sample round in February 2003.

33. Page 4-12, Section 4.6.2 – Olin states: "In addition, ceasing groundwater extraction from residential wells will allow the groundwater to return to its natural migration pathway and further protect other wells within the GW-1 area." Olin has not provided any evidence to support this claim. The drawdown from these wells could be having the opposite effect, in that they prevent more highly contaminated groundwater from reaching other nearby wells. Olin shall provide evidence for this claim or remove it from all FS reports.

Olin Response to Comment 33

Olin believes it is important to retain the statement because it is consistent with the known directions of groundwater flow and its relationship to the existing groundwater plume. Olin will provide additional discussion of the geochemistry of these wells and how pumping of these residential cause's lateral migration of groundwater adjacent to the plume. In essence the pumping induced migration is similar to salt water intrusion in crystalline coast aquifers. If wells are located a sufficient distance from the source of saline water, they may not ever be affected. When overdevelopment results in clusters of wells aligned along geologic strike of the fracture network, the well located closure to the saline front can pull saline water closure to the other wells and the saline front moves along a series of wells, essentially leapfrogging from well to well. If pumping ceases the fresh water aquifer lenses eventually displaces the intruded saline water and initial equilibrium conditions can eventually be reestablished.

EPA Response to Olin Response to Specific Comment 33

EPA will review the additional discussion provided by Olin.

34. Page 4-13, Section 4.7.1.1 – Olin states: "Alternatives 2 and 3 address the extraction of DAPL, to the extent practicable…" This is a misleading statement. These alternatives only propose extracting DAPL from the Off-PWD DAPL Pool. Olin shall modify or remove this statement.

Olin Response to Comment 34

The IAFS will address DAPL source control.

EPA Response to Olin Response to Specific Comment 34

Acknowledged.

35. Section 5 – Olin shall develop a more comprehensive set of alternatives (see General Comment 11, above) and select alternatives that satisfy the requirements of the NCP, are protective of human health and the environment, and comply with ARARs. Accordingly, the alternatives recommended by Olin are not acceptable to EPA.

Olin Response to Comment 35

Olin proposes that it and USEPA engage in additional discussion of RAOs for the Site and potential range of alternatives that meet long term site management objectives.

EPA Response to Olin Response to Specific Comment 35

See EPA response to Olin's Response to General Comment 3.

36. Tables 2.1-1, 2.1-2 and 2.1-3 (ARARs Tables) - Olin shall replace Tables 2.1-1, 2.1-2, and 2.1-3 with new tables that use Appendix 6 - Attachment 1 (Potentially Applicable or Relevant and Appropriate Requirements and To Be Considered Advisories, Criteria or Guidance**)** and Appendix 6 - Attachment 2 (Evaluation of Compliance with ARARs and TBCs for All Media**)** as a starting point for further development in the Source Control FS Report. Appendix 6 - Attachment 1 includes tables of potentially applicable or relevant and appropriate requirements ("ARARs") and "to be considered" advisories, criteria or guidance ("TBCs") that are location-specific, chemical-specific, and action specific. Appendix 6 - Attachment 2 includes tables that show the required level of alternative-specific ARAR analysis required for an FS. The tables included in Appendix 6 - Attachment 2 are provided as examples only to show the level of ARAR analysis required for each remedial alternative included in all FS reports. Due to the lack of remedial alternatives developed and evaluated in the Draft OU3 FS Report, the associated ARAR analysis is similarly deficient. All FS reports shall contain a detailed analysis of each remedial alternative that summarizes which requirements are applicable or relevant and appropriate (or TBC) for each alternative and describes how each alternative meets these requirements. When an ARAR will not be met, the basis for justifying one of the six ARAR waivers provided by CERCLA §121(d)(4) shall be discussed. EPA reserves the right to provide further comments regarding the ARAR analysis completed in all FS reports.

Olin Response to Comment 36

Olin requests a more detailed discussion with USEPA regarding this comment prior to developing the Further Groundwater FS.

EPA Response to Olin Response to Specific Comment 36

EPA reiterates its original comment in its entirety, including that the IAFS shall contain a detailed analysis of each remedial alternative that summarizes which requirements are applicable or relevant and appropriate (or TBC) for each alternative and describes how each alternative meets these requirements, using the format provided in the referenced Appendix 6 – Attachments 1 and 2. When an ARAR will not be met, the basis for justifying one of the six ARAR waivers provided by CERCLA §121(d)(4) shall be discussed. To the extent that Olin requests further clarification from EPA regarding ARARs, EPA is willing to have additional discussions.

37. Table 2.1-3 – Olin shall include evaluation of the following remediation technologies / process options: thermal, chemical (ZVI), and enhanced bioremediation using propane.

Olin Response to Comment 37

Olin will revise the Further Groundwater FS to include an evaluation of the requested remedial technologies/process options.

EPA Response to Olin Response to Specific Comment 37

Acknowledged.

38. Table 2.3-1 – Olin shall correct the following deficiencies:
    a. The table does not consider remedial approaches that include combinations of technologies. Technologies were inappropriately screened out if they were not capable of achieving all the stated RAOs independently.
    b. Technologies that were screened out solely because they are not able to treat NDMA should be retained to be evaluated in combination with methods that can treat NDMA.
    c. The FS did not include a complete evaluation of ex-situ water treatment methodologies.
    d. The FS did not include a complete evaluation of in-situ water treatment technologies, including in-situ geochemical fixation.
    e. Groundwater extraction methods should include consideration of interceptor/extraction trench and/or directionally-drilled extraction wells.
    f. Soil excavation shall be considered for the Containment Area.
    g. ISCO shall be retained for groundwater treatment.
    h. UV oxidation shall be retained for groundwater treatment.
    i. Containment remedies shall include hydraulic containment response actions, such as groundwater extraction for hydraulic control.

j. In-situ grouting shall be retained as a possible containment remedy associated with bedrock groundwater contamination.
k. Soil freezing shall be considered as a possible containment remedy in combination with groundwater extraction and treatment in localized DAPL areas.

Olin Response to Comment 38

Olin requests further detailed discussions with EPA regarding the requests made in this comment. A number of the technologies identified are clearly not feasible, reasonable or warranted. These statements by USEPA are general in nature and are not specific with regard to location or contaminant. Olin does not intend to address contaminant sources of other parties such as chlorinated solvents or arsenic associated with other area landfills. Olin does not intend to address groundwater restoration where groundwater is not a current or potential future groundwater source. These issues must be further discussed and resolved before the IAFS or Further Groundwater FS can be completed.

EPA Response to Olin Response to Specific Comment 38

EPA is willing to have additional discussions with Olin regarding the issues identified in its response, but such discussions shall not delay the submittal of the IAFS.

39. Figure 1.3-1 includes orange polygons that are not listed on the legend (source areas). Olin shall revise accordingly.

Olin Response to Comment 39

Olin will revise the legend in the figures to identify the orange polygons.

EPA Response to Olin Response to Specific Comment 39

Acknowledged.